8EHQ_0904_15578S

RECEIVED
04 SEP -2 AM 11:25

Mr. Terry O'Bryan
Environmental Scientist
Office of Pollution Prevention and Toxics
U.S. Environmental Protection Agency

Dear Mr. Terry O'Bryan

We will send replies to your requests of June 29, 2004.

Our number is 8EHQ-04-15578.

RECEIVED
2004 SEP 20 PM 12:26

Sincerely,

Fumikazu Machino

Manager

218914

1.Replies to the questions

The U.S. Importer

ANA Trading Corp., U.S.A.
Gateway Towers-East Suite 600, M/S 30, Torrance, California 90502
Tel: 310-329-0211
Yoh Ishikawa, Senior Manager

The uses of This Carbon Fiber

Thermal Acoustic Insulation for Commercial Airplane

Available Information

The following submission (Confidential Version, Sanitized Version) was attached.

TITLE: Industrial Hygiene Evaluation of Carbon Fiber Insulation Processing Operations (Clayton Environmental Consultants)

COMMENT: This Clayton industrial hygiene study was a very small study done in a simulated factory environment, and only took 2 area and 2 personal samples for each of 3 different operations. Then, we have changed the manufacture method and do not know whether this study is effective.

2.COMMENT

We have developed this carbon fiber material in Japan, and adoption test as for an aircraft insulation batting were conducted by the one user in the U.S.A. Since the user has decided not to adopt this material as their material candidate, all development activities were abandoned from June, 2004.

[redacted]

Industrial Hygiene Evaluation of Carbon Fiber Insulation Processing Operations for

[redacted]

REVISED
June 28, 1999

Clayton
ENVIRONMENTAL
CONSULTANTS

Clayton Project No. 75-99243

4636 E. Marginal Way S., Suite 215
Seattle, Washington 98134

CONTENTS

1.0 INTRODUCTION

[redacted] Inc., authorized Clayton Environmental Consultants, a division of Clayton Group Services, Inc., to evaluate exposures to carbon fibers during simulated process handling operations using three new types of aerospace insulation. The purpose of the evaluation was to closely match the processes measured during the previous survey conducted in 1996 and compare the results.

[redacted] shipped the samples, identified each during the survey, and assisted with the survey.

Michael Krause, Certified Industrial Hygienist (CIH) from Clayton, coordinated the survey, arranged for space and equipment, set up the sampling strategy, conducted air monitoring while performing the cutting and bagging operations, compiled the data, and wrote the final report.

2.0 EXECUTIVE SUMMARY

Clayton Environmental Consultants conducted personal and area monitoring during aerospace insulation processing operations using three new carbon fiber materials on April 9, 1999. A report was issued on April 20, 1999. The electron microscopy data was re-analyzed and a revised report was issued, which is incorporated herein.

Nine personal and nine area samples were collected and first analyzed for airborne fiber count using phase contrast microscopy (PCM). See Tables 1 through 3 in Appendix A.

In general, there did not appear to be a major difference in airborne fiber levels from the new 1999 materials when compared with those in 1996, keeping in mind that the experimental error of the PCM method is approximately plus or minus 25% and that matching experimental conditons exactly was very difficult. There appeared to be a trend toward lower emissions from the 1999 specimen #1 in template cutting and band sawing, but the reverse was seen in the bagging operation.

The nine personal samples collected during processing of carbon fiber insulation were also analyzed by transmission electron microscopy (TEM) for airborne concentration and for fiber sizing. The revised TEM report from the Clayton Atlanta lab is presented in Appendix C. The airborne concentrations of "total" and "respirable" fibers were about the same. The ratio of the airborne TEM counts compared to PCM results was approximately 2 to 1. See Table 4. This is the same as the 1996 results, as shown in Table 5. Table 6 shows an overall comparison of 1999 versus 1996 results.

The TEM fiber size distributions reported show that on average the 1999 specimens were somewhat shorter and thinner than the 1996 samples. The average percentage of fibers less than 5 microns in length in 1999 was 12%, while in 1996 it was 2%. Approximately 8% of the 1999 fibers were less than 0.25 microns in diameter, while none of those in 1996 were. Approximately 33% of the 1999 fibers were over 2 microns in width while 20% of those in 1996 were.

3.0 PROCESS DESCRIPTION

Three new types of insulation were processed. All of these carbon fiber blankets measured 72 inches long x 32 inches wide x 1 inch thick. The first insulation, identified by Mr. Machino as the newest, was identified as specimen number 1 (CF1 in this report), and was handled first at his request. The second specimen (CF2), reportedly somewhat older, was processed next. Both CF1 and CF2 were reportedly "coated" or treated with a binder that could potentially reduce airborne fiber generation. Sample number 3 (CF3) was reportedly similar, although not identical, to the material used in 1996.

Simulated operations involved template cutting by hand, band saw cutting of the batting, and bagging of the remnants of the two cutting operations. Refer to the pictures on the next two pages.

Template cutting was conducted in the Clayton Seattle equipment lab. The blankets were cut with a pocket knife with a 4" blade, like the 1996 survey. One 15" square, one 12" triangle, and one 12" diameter circle were cut from each blanket and the pieces were removed and stacked. Sampling was stopped at this point.

The air in the room was removed by turning on the exhaust hood on the work bench after each sampling trial. The operator's disposable coveralls were removed after each sampling event to prevent cross contamination. New samples were collected during pick up and bagging of the scrap materials from template cutting. The same cassettes were used later for collecting fibers from cleanup and bagging of bandsaw scrap insulation. Between specimens, the work area and templates were HEPA vacuumed (3M hand-held unit) and wet cleaned with baby wipes.

The band saw simulations were conducted in a large, open warehouse/industrial building with a high ceiling next door to Clayton. The band saw was a Delta floor model JW85-14MW, 1 HP, running at the high setting (2350 FPM), with a woodworking blade in place. This was very similar to the one used in 1996, which was a Delta JW85-14DS, ¾ HP, running at 3000 FPM with reportedly a "fine" blade.

The 3M HEPA vacuum was used as a local exhaust system for the bandsaw to simulate 1996 conditions. The inlet for the hose was placed under the saw table approximately 6" below the point of cutting. After each trial, the saw and immediate area were HEPA vacuumed thoroughly and the diposable coveralls were changed. There was no air

handling unit for the building or fan running near the bandsaw. There was no exhaust ventilation available to clear the area after each test.

4.0 SAMPLING AND ANALYSIS

Breathing zone air samples were collected on the operator performing the cutting and bagging operations. Area samples were collected approximately six feet from each operation.

Samples for phase contrast microscopy (PCM) and transmission electron microscopy (TEM) fiber analysis were collected on 25 mm mixed cellulose ester filters inside cassettes with cowel extensions. Sampling pumps were calibrated before and after each major sampling event using a Bios Dry-Cal calibrator. Sampling pump flow rates were approximately 4 liters per minute.

Phase contrast microscopy (PCM) "counting" was conducted by Clayton's American Industrial Hygiene Association (AIHA) accredited asbestos laboratory in Seattle, Washington by Pat Lukens, Laboratory Manager. PCM analysis was conducted in accordance with the method recommended in the NIOSH Criteria Document for Fibrous Glass (No. 77-152), matching the method requested by Osaka Gas in the 1996 study. The counting criteria are fibers over 10 microns long with a length to width (aspect) ratio of at least 3:1.

Follow-up transmission electron microscopy (TEM) analysis of the nine personal samples was conducted by Alan Segrave, Laboratory Manager at the AIHA accredited Clayton Particle Analysis Laboratory in Atlanta, Georgia. TEM analysis was conducted in accordance with the international World Health Organization (WHO) counting rules, matching the method requested by Osaka Gas in 1996.

Air samples were collected for the duration of the three processes conducted on the three new carbon fiber materials. Potential time-weighted averages were calculated using average workshift exposure times of seven hours and forty-five minutes per task per workshift. Estimated exposure times were provided by Osaka Gas.

The bandsaw cutting airborne results were modified somewhat to equilibrate the number of cuts between specimens. The results for specimens 2 and 3 were proportioned to match the emissions from the 49 cuts made across the width of the specimen 1 blanket.

5.0 RESULTS AND DISCUSSION

Air sampling results are tabulated and compared in Appendix A. Supporting analytical data from the Seattle laboratory is shown as Appendix B. Supporting analytical data from the Atlanta laboratory is shown as Appendix C.

Airborne PCM fiber levels were compared with the most relevant published exposure guideline in the ACGIH TLVs (American Conference of Governmental Industrial Hygienists Threshold Limit Values). The 1999 TLV booklet lists a recommended limit of 1 fiber per cubic centimeter of air (f/cc) for non-carcinogenic synthetic vitreous fibers (fiberglass). This is the same fiberglass limit recommended by Johns Manville as a Workplace Exposure Guideline, used for comparison in the 1996 survey.

The various fiber counting rules used for comparison with these limits are confusing. The criteria for each is summarized below:

Method	Length	Width	Aspect Ratio
NIOSH 7400 Method, "B" counting rules	>5 microns	<3 microns	≥5:1
NIOSH Fibrous Glass Criteria Document	>10	any	≥3:1
NIOSH 7402 Method for TEM	>5	>0.25	≥3:1
WHO Recommended Method by PCM:			
Total Fibers	any	any	≥3:1
Respirable Fibers	>5	<3	≥3:1

The most widely recognized analytical method for non-asbestos fibers is NIOSH Method 7400, under the "B" counting rules. This is the method currently used by Johns Manville for fiberglass analysis and is the method specified for the ACGIH TLV. Ms. Lukens stated that few of the fibers counted in this survey were under 10 microns in length, so the Criteria Document results should be fairly comparable to 7400 Method counts.

There are no specific recommended or OSHA limits for carbon fibers per se. OSHA would enforce not a "count," but a "mass-in air" generic limit of 15 milligrams per cubic meter of air (mg/m^3) for total non-carcinogenic particulate matter (not otherwise classified) and a limit of 5 mg/m^3 for respirable particulate. No WHO recommended exposure limits could be found on their website.

Nine personal breathing zone samples, nine area samples and two blanks were analyzed by PCM. In general, there did not appear to be a major reduction in airborne fiber levels from the new 1999 materials when compared with those in 1996, keeping in mind that the experimental error of the PCM method is approximately plus or minus 25%. Among the three 1999 materials, there was a trend toward lower emissions from specimen 1 in template cutting and band sawing, but the reverse was seen in the bagging operation.

For template cutting, all 1999 personal / breathing zone samples were above the chosen guideline of 1 f/cc (fiber per cubic centimeter of air). A visible "puff" of dust was seen

upon each cut with the knife. Airborne concentrations from specimen 1 were similar to the 1996 data. The 1999 specimens 2 and 3 produced higher levels. All area samples six feet away were well below the guideline, but 1999 data appeared to be higher. See Table 1.

For bandsaw cutting, all 1999 personal / breathing zone samples were below the chosen guideline of 1 f/cc (fiber per cubic centimeter of air) and well below 1996 levels. The exhaust ventilation on the bandsaw may have been more effective in 1999. There was surprising little visible airborne dust generated. Area samples six feet away were well below the guideline, but somewhat higher for the 1999 specimens 2 and 3. See Table 2.

For collecting and bagging of scrap material, all 1999 personal / breathing zone samples were well above the chosen guideline of 1 f/cc (fiber per cubic centimeter of air) and higher than the 1996 results. During bagging of scraps from the bandsaw, visible dust was observed. All area samples six feet away were at or below the guideline, but higher for the 1999 specimens. See Table 3.

The nine personal samples collected during processing of carbon fiber insulation were also analyzed by transmission electron microscopy (TEM) for airborne concentration and for fiber sizing.

Mr. Segrave discussed the TEM results with Mr. Krause on April 23, 1999. Mr. Segrave stated that the carbon fibers appeared to look like 2x4 lumber or were "blade-like". He recollected that the appearance of the fibers under TEM in 1996 was different than that of the current three specimens. Approximately 2-3% of the new fibers had a bulbous formation about ¼ of the way down the fiber, like the "duck head" or "green onion" shapes seen in molten/blown mineral wool.

Refer to the TEM report and graphs in Appendix C. Also see Tables 4, 5, and 6 in Appendix A.

For template cutting, the total TEM fiber counts were somewhat lower than the 1996 data.

For bandsaw cutting, the total TEM fiber counts were much lower than the 1996 data.

For collecting and bagging of scrap material, the total TEM fiber counts in 1999 were similar to the 1996 data.

Potential follow-up activities are listed below:

1. Further data manipulation can be conducted by the Atlanta laboratory to better define and compare carbon fiber sizes among all the old and new insulation materials.

2. Further research can be conducted to determine an appropriate carbon fiber exposure limit for Osaka Gas to recommend to customers. This would include further study of the WHO criteria and other international standards.

3. Further research can be conducted to choose the most appropriate PCM and TEM analytical methods for the future.

4. Osaka Gas can begin to formulate a Material Safety Data Sheet for carbon fiber materials, including information from items 2 and 3 above. Clayton is available to assist as needed.

If there are any questions or comments about this report, please contact either of the following Clayton industrial hygienists:

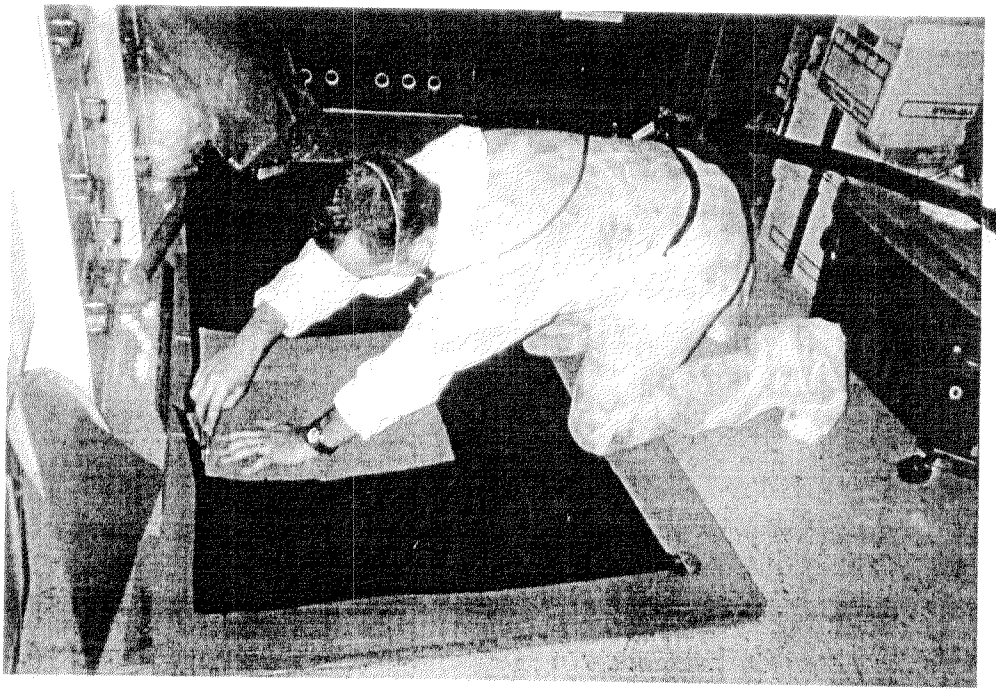
Survey and report by:

Michael Krause, CIH, CHMM
Director, Aerospace Group

Reviewed by:

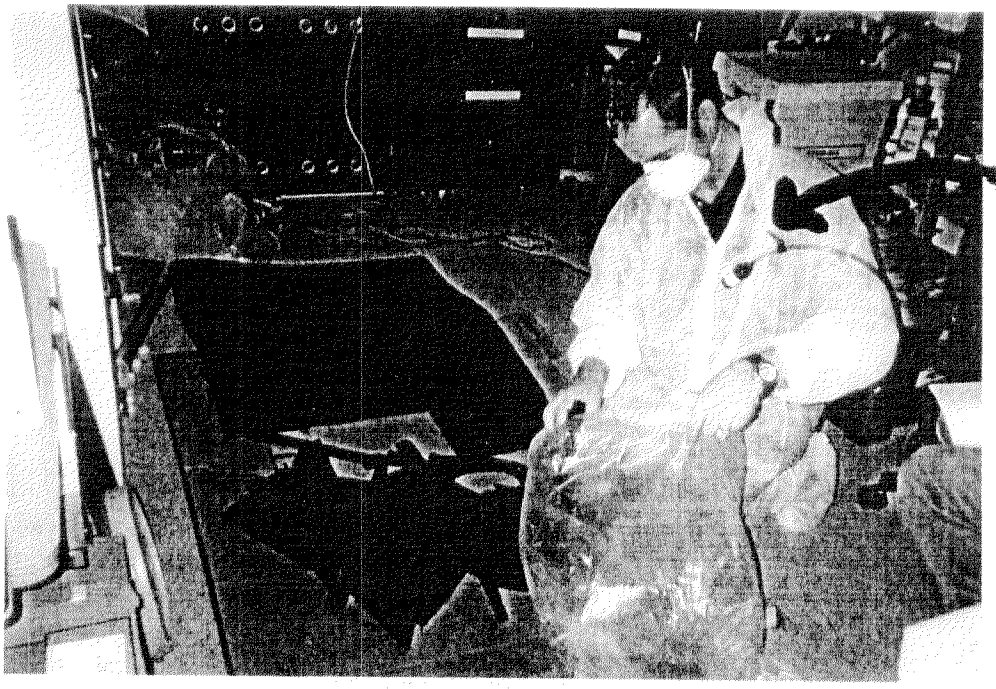
Venetia Runnion, CIH, CSP
Director, Occupational Health and Safety
Seattle Regional Office

Picture 1. Template cutting



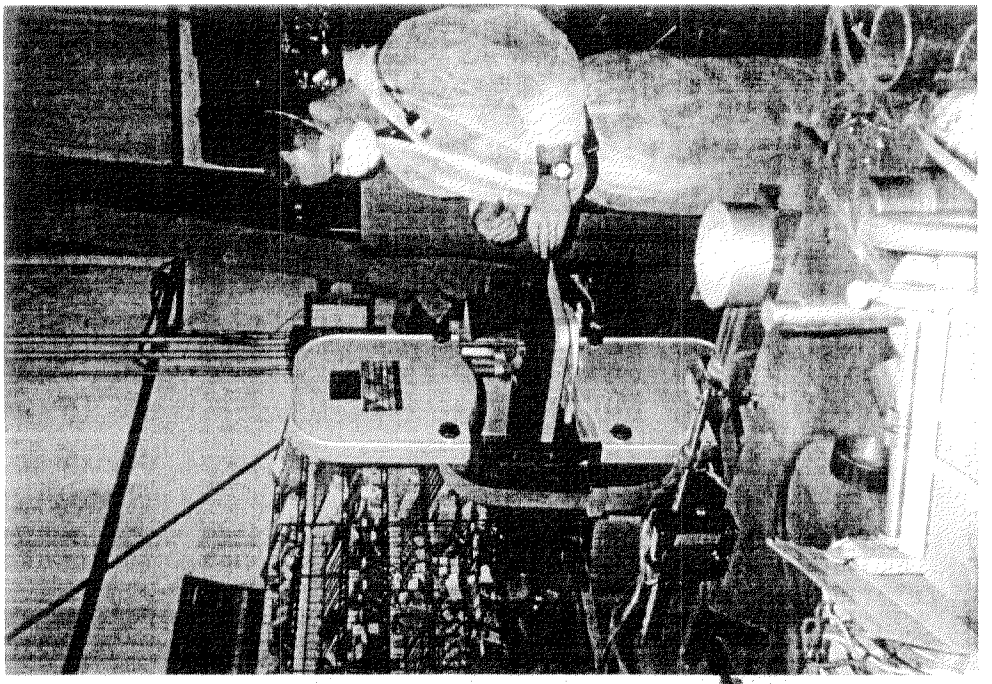
Sampling pump

Picture 2. Bagging of template scrap material



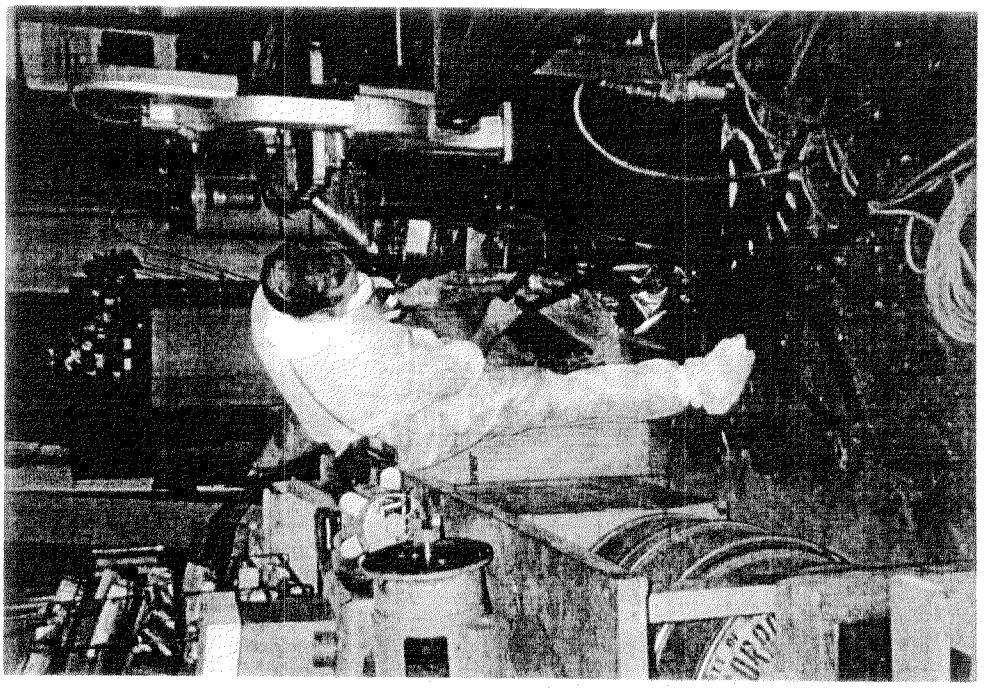
Sample cassette

Picture 3. Band saw operation



Picture 4. Bagging band saw scrap / strips

Area sample



APPENDIX A

AIR SAMPLING RESULTS TABLES

TABLE 1 - CUTTING ACOUSTICAL INSULATION TEMPLATES WITH A KNIFE

Survey Date: April 9, 1999

Project #: 75-99243

Sample Type	Sample Location	Sample Number	Sample Time (Min.)	Carbon Fiber Count		Remarks
				Measured Concentration	Calculated 8-hour TWA	
				f/cc	f/cc	
CF1 - Personal	Breathing zone, cutting 3 templates by hand on the floor	CU922	10:07-10:27 (20)	1.84	**1.8**	Sample collected during cutting of Specimen # 1 with pocket knife with 4" blade. One 12" diameter circle, one 12" triangle, one 15" square template cut and removed from insulation blanket.
CF1 - Area	six feet from cutting operation	CU932	10:06-10:27 (21)	0.23		
CF2 - Personal	Breathing zone, cutting 3 templates by hand on the floor	CU901	11:02-11:17 (15)	3.61	**3.5**	Sample collected during cutting of Specimen # 2 with pocket knife with 4" blade. One 12" diameter circle, one 12" triangle, one 15" square template cut and removed from insulation blanket.
CF2 - Area	six feet from cutting operation	CU911	11:02-11:17 (15)	0.61		
CF3 - Personal	Breathing zone, cutting 3 templates by hand on the floor	CU903	11:43-11:58 (15)	3.00	**2.9**	Sample collected during cutting of Specimen # 3 with pocket knife with 4" blade. One 12" diameter circle, one 12" triangle, one 15" square template cut and removed from insulation blanket.
CF3 - Area	six feet from cutting operation	CU914	11:43-11:58 (15)	0.49		
Most applicable ACGIH TLV-TWA (synthetic vitreous fibers):					**1.0**	
OSHA PEL (respirable particulates not otherwise classified):					NA	
Previous survey results for 1" thick insulation CF1:					**overloaded**	
Previous survey results for 1.5" thick insulation CF2:					**1.1**	

Lab Report numbers: Clayton Log # T10110

Notes: 1. f/cc = fibers per cubic centimeter of air (NIOSH 7400 Method, B counting rules, phase contrast microscopy, 400-450X)

2. Calculated Time-Weighted-Averages (TWAs) are based on Osaka's estimated seven hours and forty-five minutes conducting each task per workshift.

3. ACGIH TLV = American Conference of Governmental Industrial Hygienists Threshold Limit Value

4. OSHA PEL = Occupational Safety and Health Administration Permissible Exposure Limit

5. NA = Not Applicable. The only applicable OSHA limit is based on total weight of respirable nuisance particulate, expressed as 5 milligrams per cubic meter of air.

TABLE 2 - CUTTING ACOUSTICAL INSULATION WITH A BANDSAW

Survey Date: April 9, 1999

Project #: 75-99243

Sample Type	Sample Location	Sample Number	Sample Time (Min.)	Carbon Fiber Count		Remarks
				Measured Concentration	Calculated 8-hour TWA	
				f/cc	f/cc	
CF1 - Personal	Breathing zone, feeding bandsaw	CU935	14:41-14:59 (18)	0.62	**0.6**	Sample collected during cutting of Specimen # 1 with Delta JW85-14MW bandsaw with wood-working blade on high setting (2350 SFPM). HEPA exhaust vacuum running under table. 49 cuts across the 32" blanket width.
CF1 - Area	six feet from cutting operation	CU907	14:41-14:59 (18)	0.13		
CF2 - Personal	Breathing zone, feeding bandsaw	CU944	15:15-15:30 (15)	0.51	**0.5**	Sample collected during cutting of Specimen # 2 with Delta JW85-14MW bandsaw with wood-working blade on high setting (2350 SFPM). HEPA exhaust vacuum running under table. 54 cuts across the 32" blanket width. Data has been converted to simulate a 49 cut exposure.
CF2 - Area	six feet from cutting operation	CU946	15:15-15:30 (15)	0.69		
CF3 - Personal	Breathing zone, feeding bandsaw	CU906	15:43-15:56 (13)	0.81	**0.8**	Sample collected during cutting of Specimen # 3 with Delta JW85-14MW bandsaw with wood-working blade on high setting (2350 SFPM). HEPA exhaust vacuum running under table. 58 cuts across the 32" blanket width. Data has been converted to simulate a 49 cut exposure.
CF3 - Area	six feet from cutting operation	CU926	15:43-15:56 (13)	0.89		
Most applicable ACGIH TLV-TWA (synthetic vitreous fibers):					**1.0**	
OSHA PEL (respirable particulates not otherwise classified):					NA	
Previous survey results for 1" thick insulation CF1:					**1.8**	
Previous survey results for 1.5" thick insulation CF2:					**1.1**	

Lab Report numbers: Clayton Log # T10110

Notes: 1. f/cc = fibers per cubic centimeter of air (NIOSH 7400 Method, B counting rules, phase contrast microscopy, 400-450X)

2. Calculated Time-Weighted-Averages (TWAs) are based on Osaka's estimated seven hours and forty-five minutes conducting each task per workshift.
3. ACGIH TLV = American Conference of Governmental Industrial Hygienists Threshold Limit Value
4. OSHA PEL = Occupational Safety and Health Administration Permissible Exposure Limit
5. NA = Not Applicable. The only applicable OSHA limit is based on total weight of respirable nuisance particulate, expressed as 5 milligrams per cubic meter of air.

TABLE 3 - PICKING UP AND BAGGING INSULATION SCRAPS

Survey Date: April 9, 1999

Project #: 75-99243

Sample Type	Sample Location	Sample Number	Sample Time (Min.)	Carbon Fiber Count		Remarks
				Measured Concentration	Calculated 8-hour TWA	
				f/cc	f/cc	
CF1 - Personal	Breathing zone, picking up scraps and bagging	CU931	10:36-10:44, 15:02-15:07 (13)	4.29	**4.2**	Sample collected during cleanup of Specimen # 1. Templates cut with knife picked up and bagged, then later, strips cut with bandsaw picked up and placed in same bag.
CF1 - Area	six feet from bagging operation	CU933	10:35-10:44, 15:02-15:07 (14)	1.07		
CF2 - Personal	Breathing zone, picking up scraps and bagging	CU913	11:20-11:28 15:31-15:36 (13)	3.00	**2.9**	Sample collected during cleanup of Specimen # 2. Templates cut with knife picked up and bagged, then later, strips cut with bandsaw picked up and placed in same bag.
CF2 - Area	six feet from bagging operation	CU923	11:20-11:28 15:31-15:36 (13)	0.16		
CF3 - Personal	Breathing zone, picking up scraps and bagging	CU904	12:00-12:08 15:58-16:06 (16)	3.23	**3.1**	Sample collected during cleanup of Specimen # 3. Templates cut with knife picked up and bagged, then later, strips cut with bandsaw picked up and placed in same bag.
CF3 - Area	six feet from bagging operation	CU915	12:00-12:08 15:58-16:06 (16)	0.44		
Most applicable ACGIH TLV-TWA (synthetic vitreous fibers):					**1.0**	
OSHA PEL (respirable particulates not otherwise classified):					NA	
Previous survey results for 1" thick insulation CF1:					**1.9**	
Previous survey results for 1.5" thick insulation CF2:					**0.9**	

Lab Report numbers: Clayton Log # T10110

Notes: 1. f/cc = fibers per cubic centimeter of air (NIOSH 7400 Method, B counting rules, phase contrast microscopy, 400-450X)

2. Calculated Time-Weighted-Averages (TWAs) are based on Osaka's estimated seven hours and forty-five minutes conducting each task per workshift.
3. ACGIH TLV = American Conference of Governmental Industrial Hygienists Threshold Limit Value
4. OSHA PEL = Occupational Safety and Health Administration Permissible Exposure Limit
5. NA = Not Applicable. The only applicable OSHA limit is based on total weight of respirable nuisance particulate, expressed as 5 milligrams per cubic meter of air.

TABLE 4 REVISED - COMPARISON OF 1999 PCM AND TEM RESULTS

Survey Date: April 9, 1999

Project #: 75-99243

Sample Type	Process	Sample Number	Carbon Fiber Count				Remarks
			Measured Concentration PCM	Total Concentration TEM	Respirable Concentration TEM	Ratio TEM/PCM	
			f/cc	f/cc	f/cc		
CF1 - Personal	Template Cutting	CU922	1.84	4.50		2.4	
					3.90	2.1	
CF1 - Personal	Bandsaw Cutting	CU935	0.62	0.46		0.7	outlier
					0.37	0.6	
CF1 - Personal	Bagging Scrap Material	CU931	4.30	11.00		2.6	
					10.50	2.4	
CF2 - Personal	Template Cutting	CU901	3.61	8.90		2.5	
					8.70	2.4	
CF2 - Personal	Bandsaw Cutting	CU944	0.51	0.95		1.9	
					0.86	1.7	
CF2 - Personal	Bagging Scrap Material	CU913	3.00	6.60		2.2	
					6.14	2.0	
CF3 - Personal	Template Cutting	CU903	3.00	10.00		3.3	
					9.62	3.2	
CF3 - Personal	Bandsaw Cutting	CU906	0.81	1.40		1.7	
					1.40	1.7	outlier
CF3 - Personal	Bagging Scrap Material	CU904	3.24	7.10		2.2	
					6.58	2.0	
Most applicable ACGIH TLV-TWA (synthetic vitreous fibers):			**1.0**				

Notes: 1. f/cc = fibers per cubic centimeter of air

2. PCM = NIOSH 7400 Method, B counting rules, phase contrast microscopy, 400-450X, fibers >5 microns long, <3 microns wide, 3:1 aspect ratio
3. TEM Total = WHO counting rules by Transmission Electron Microscopy, 15,000 X, aspect ratio over 3:1, no size restriction
4. TEM Respirable = WHO counting rules by Transmission Electron Microscopy, 15,000 X, aspect ratio over 3:1, >5 microns long and < 3 microns wide

TABLE 6 - COMPARISON OF 1999 VERSUS 1996 RESULTS

Survey Date: April 9, 1999 and December 19,1996

Project #: 75-99243

Sample Type	Process	Sample Number	1999 Measured Concentration PCM f/cc	1996 Measured Concentration PCM f/cc	1999 Total Fibers TEM f/cc	1996 Total Fibers TEM f/cc	Remarks
CF1 - Personal	Template Cutting	CU922	1.84	1.58	4.5	5.6-6.6	See Note 4
CF1 - Personal	Bandsaw Cutting	CU922	0.62	1.18-1.85	0.6	2.2-3.8	
CF1 - Personal	Bagging Scrap Material	CU922	4.30	0.90-2.00	4.3	2.6-8.2	
CF2 - Personal	Template Cutting	CU901	3.61	1.58	3.6	5.6-6.6	
CF2 - Personal	Bandsaw Cutting	CU944	0.51	1.18-1.85	0.5	2.2-3.8	
CF2 - Personal	Bagging Scrap Material	CU913	3.00	0.90-2.00	3.0	2.6-8.2	
CF3 - Personal	Template Cutting	CU903	3.00	1.58	3.0	5.6-6.6	
CF3 - Personal	Bandsaw Cutting	CU906	0.81	1.18-1.85	0.7	2.2-3.8	
CF3 - Personal	Bagging Scrap Material	CU904	3.24	0.90-2.00	3.2	2.6-8.2	
Most applicable ACGIH TLV-TWA (synthetic vitreous fibers):			**1.0**	**1.0**			

Notes: 1. f/cc = fibers per cubic centimeter of air

2. PCM = NIOSH 7400 Method, B counting rules, phase contrast microscopy, 400-450X, fibers >5 microns long, <3 microns wide, 3:1 aspect ratio

3. TEM Total = WHO counting rules by Transmission Electron Microscopy, 15,000 X, aspect ratio over 3:1, no size restriction

4. Comparison is for illustration purposes only. The 1999 and 1996 samples were reportedly not exactly the same materials. 1996 data is compiled.

APPENDIX B

PCM ANALYSIS DATA SHEETS

Clayton ENVIRONMENTAL CONSULTANTS

4636 E. Marginal Way So. Suite 215
Seattle, WA 98134
(206) 763-7364

AN AIHA ACCREDITED LABORATORY #414

AIR SAMPLE DATA

Log # T10110
Project # 75-99243.00
Number of Samples: 20

PO #: N/A

Job Location: **Clayton Office**

Abatement Firm: **N/A**

SAMPLE # CU932
SAMPLE TYPE: **Area**
PUMP # 528754
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS: N/A, N/A, N/A

LOCATION: **6' from cutting operation on floor**
OBSERVATIONS: **Newest material #1 (CF-1)**

NAME: SS# CERT#

TIME			FLOW RATE (LPM)		VOLUME	Fibers/	Fiber Concentration		
		Total		Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	10:06		Start: 4.22						
End:	10:27	21	End: 4.20	4.21	88	42 / 100	52.9	20,354	0.230

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: 5 2,000

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU922
SAMPLE TYPE: **Breathing Zone**
PUMP # 546229
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS: N/A, N/A, N/A

LOCATION: **Breathing zone**
OBSERVATIONS: **Newest material #1 (CF-1), Cut 3 templates with knife, with 4" blade, on floor**

NAME: **Michael Krause** SS# CERT#

TIME			FLOW RATE (LPM)		VOLUME	Fibers/	Fiber Concentration		
		Total		Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	10:07		Start: 4.12						
End:	10:27	20	End: 4.11	4.12	82	108 / 35	392.4	151,092	1.836

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: 5 2,000

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU931
SAMPLE TYPE: **Breathing Zone**
PUMP # 546229
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS: N/A, N/A, N/A

LOCATION: **Breathing zone**
Newest material #1
OBSERVATIONS: **Pick up and bag scrap material**
***Note: Start/stop times: Template scrap 10:36-10:44, Band saw scrap 15:02-15:07**

NAME: **Michael Krause** SS# CERT#

TIME			FLOW RATE (LPM)		VOLUME	Fibers/	Fiber Concentration		
		Total		Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	*		Start: 4.11						
End:	*	13	End: 4.09	4.10	53	103 / 22	595.8	229,373	4.303

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: 5 2,000

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

Microscope field area (mm²): 0.00785
Filter size (mm): 25 Effective Filter Area (mm²): 385
Control slide: 93-14 Result (f/mm²) 52.2

Detection Limits of Blank Corrected Fiber Count (Fibers/Field): 0.04
Blank 1: CU925 Blank 2: CU934
Blank Average: .5 / 100

Sampled by: **Michael Krause** Company: **Clayton Environmental Consultants**
Received by: **Rachel Melgoza** Date: **4/12/99**
Microscopist: **Patricia Lukens** Date Analyzed: **4/14/99** Checked by Patricia Lukens

Samples are collected and analyzed according to NIOSH 7400 (Issue 8/15/94) and/or State/OSHA Reference Methods via Phase Contrast Microscope (PCM) by NIOSH 582 trained, PAT or AIHA Registry participating analysts. Flow calibration is performed before and after sampling.
Intralaboratory Sr: (6.4 - 25.5 fibers/100 fields) 0.43; (25.6 -63.7 fibers/100 fields) 0.38; (63.8 -127.4 fibers/100 fields) 0.29; (>127.4 fibers/100 fields) 0.53
Interlaboratory Sr: 0.40

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Seattle, WA 98134
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AIR SAMPLE DATA

AN AIHA
ACCREDITED
LABORATORY #414

Log # T10110
Project # 75-99243.00
Number of Samples: 20

PO #: N/A

Job Location: **Clayton Office**

Abatement Firm: **N/A**

SAMPLE # CU933
SAMPLE TYPE
Area
PUMP # 528754
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS:
N/A
N/A
N/A

LOCATION: **6' from operation**
Newest material #1
OBSERVATIONS: **Pick up and bag scrap material**
***Note: Start/stop times: Template scrap 10:35-10:44, Band saw scrap 15:02-15:07**

NAME: SS# CERT#

TIME			FLOW RATE (LPM)			VOLUME	Fibers/	Fiber Concentration		
		Total			Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	*		Start:	4.20						
End:	*	14	End:	4.15	4.18	58	109 / 85	162.7	62,647	1.072

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU935
SAMPLE TYPE
Breathing Zone
PUMP # 546229
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS:
N/A
N/A
N/A

LOCATION: **Breathing zone**
OBSERVATIONS: **Newest material #1 (CF-1), 49 strips cut with band saw**

NAME: **Michael Krause** SS# CERT#

TIME			FLOW RATE (LPM)			VOLUME	Fibers/	Fiber Concentration		
		Total			Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	14:41		Start:	4.11						
End:	14:59	18	End:	4.11	4.11	74	94 / 100	119.1	45,857	0.620

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU907
SAMPLE TYPE
Area
PUMP # 528754
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS:
N/A
N/A
N/A

LOCATION: **6' from band saw**
OBSERVATIONS:

NAME: SS# CERT#

TIME			FLOW RATE (LPM)			VOLUME	Fibers/	Fiber Concentration		
		Total			Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	14:41		Start:	4.20						
End:	14:59	18	End:	4.18	4.19	75	20 / 100	24.8	9,564	0.127

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

Microscope field area (mm²): 0.00785
Filter size (mm): 25 Effective Filter Area (mm²): 385
Control slide: 93-14 Result (f/mm²) 52.2

Detection Limits of Blank Corrected Fiber Count (Fibers/Field): 0.04
Blank 1: CU925 Blank 2: CU934
Blank Average: .5 / 100

Sampled by: **Michael Krause** Company: **Clayton Environmental Consultants**
Received by: **Rachel Melgoza** Date: **4/12/99**
Microscopist: **Patricia Lukens** Date Analyzed: **4/14/99** Checked by Patricia Lukens

Samples are collected and analyzed according to NIOSH 7400 (Issue 8/15/94) and/or State/OSHA Reference Methods via Phase Contrast Microscope (PCM) by NIOSH 582 trained, PAT or AIHA Registry participating analysts. Flow calibration is performed before and after sampling.
Intralaboratory Sr: (6.4 - 25.5 fibers/100 fields) 0.43; (25.6 -63.7 fibers/100 fields) 0.38; (63.8 -127.4 fibers/100 fields) 0.29; (>127.4 fibers/100 fields) 0.53
Interlaboratory Sr: 0.40

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LABORATORY #414

AIR SAMPLE DATA

Log # T10110
Project # 75-99243.00
Number of Samples: 20

PO #: N/A

Job Location: **Clayton Office**

Abatement Firm: **N/A**

SAMPLE # CU901
SAMPLE TYPE: **Breathing Zone**
PUMP # 546229
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS: N/A, N/A, N/A

LOCATION: **Breathing zone**

OBSERVATIONS: **Material #2 (CF-2) - Cutting same 3 templates**

NAME: **Michael Krause** SS# CERT#

TIME			FLOW RATE (LPM)		VOLUME	Fibers/	Fiber Concentration		
		Total		Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	11:02		Start: 4.07						
End:	11:17	15	End: 4.07	4.07	61	103.5 / 23	572.6	220,455	**3.611**

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU911
SAMPLE TYPE: **Area**
PUMP # 528754
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS: N/A, N/A, N/A

LOCATION: **6' from cutting operation on floor**

OBSERVATIONS:

NAME: SS# CERT#

TIME			FLOW RATE (LPM)		VOLUME	Fibers/	Fiber Concentration		
		Total		Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	11:02		Start: 4.13						
End:	11:17	15	End: 4.11	4.12	62	78 / 100	98.7	38,010	**0.615**

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU913
SAMPLE TYPE: **Breathing Zone**
PUMP # 546229
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS: N/A, N/A, N/A

LOCATION: **Breathing zone**
Material #2 (CF-2)

OBSERVATIONS: **Pick up and bag scrap material, 54 cuts**
***Note: Start/stop times: Template scrap 11:20-11:28, Band saw scrap 15:31-15:36**

NAME: **Michael Krause** SS# CERT#

TIME			FLOW RATE (LPM)		VOLUME	Fibers/	Fiber Concentration		
		Total		Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	*		Start: 4.10						
End:	*	13	End: 4.09	4.10	53	124 / 38	415.1	159,795	**3.002**

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

Microscope field area (mm²): 0.00785
Filter size (mm): 25 Effective Filter Area (mm²): 385
Control slide: 93-14 Result (f/mm²) 52.2

Detection Limits of Blank Corrected Fiber Count (Fibers/Field): 0.04
Blank 1: CU925 Blank 2: CU934
Blank Average: .5 / 100

Sampled by: **Michael Krause** Company: **Clayton Environmental Consultants**
Received by: **Rachel Melgoza** Date: **4/12/99**
Microscopist: **Patricia Lukens** Date Analyzed: **4/14/99** Checked by Patricia Lukens

Samples are collected and analyzed according to NIOSH 7400 (Issue 8/15/94) and/or State/OSHA Reference Methods via Phase Contrast Microscope (PCM) by NIOSH 582 trained, PAT or AIHA Registry participating analysts. Flow calibration is performed before and after sampling.
Intralaboratory Sr: (6.4 - 25.5 fibers/100 fields) 0.43; (25.6 -63.7 fibers/100 fields) 0.38; (63.8 -127.4 fibers/100 fields) 0.29; (>127.4 fibers/100 fields) 0.53
Interlaboratory Sr: 0.40

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AIR SAMPLE DATA

Log # T10110
Project # 75-99243.00
Number of Samples: 20

PO #: N/A

Job Location: **Clayton Office**

Abatement Firm: **N/A**

SAMPLE # CU923
SAMPLE TYPE: **Area**
PUMP # 528754
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS: N/A / N/A / N/A

LOCATION: **6' from bagging operation**

OBSERVATIONS: ***Note: Start/stop times: Template scrap 11:20-11:28, Band saw scrap 15:31-15:36**

NAME: SS# CERT#

TIME			FLOW RATE (LPM)		VOLUME	Fibers/	Fiber Concentration		
		Total		Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	*		Start: 4.10						
End:	*	13	End: 4.10	4.10	53	18 / 100	22.3	8,583	**0.161**

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU944
SAMPLE TYPE: **Breathing Zone**
PUMP # 546229
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS: N/A / N/A / N/A

LOCATION: **Breathing zone**

OBSERVATIONS: **Material #2 (CF-2) - 54 cuts with band saw**

NAME: **Michael Krause** SS# CERT#

TIME			FLOW RATE (LPM)		VOLUME	Fibers/	Fiber Concentration		
		Total		Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	15:15		Start: 4.11						
End:	15:30	15	End: 4.11	4.11	62	65 / 100	82.2	31,634	**0.513**

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU946
SAMPLE TYPE: **Area**
PUMP # 528754
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS: N/A / N/A / N/A

LOCATION: **6' from band saw cutting**

OBSERVATIONS:

NAME: SS# CERT#

TIME			FLOW RATE (LPM)		VOLUME	Fibers/	Fiber Concentration		
		Total		Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	15:15		Start: 4.16						
End:	15:30	15	End: 4.12	4.14	62	88.5 / 100	112.1	43,159	**0.695**

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

Microscope field area (mm²): 0.00785
Filter size (mm): 25 Effective Filter Area (mm²): 385
Control slide: 93-14 Result (f/mm²) 52.2

Detection Limits of Blank Corrected Fiber Count (Fibers/Field): 0.04
Blank 1: CU925 Blank 2: CU934
Blank Average: .5 / 100

Sampled by: **Michael Krause** Company: **Clayton Environmental Consultants**
Received by: **Rachel Melgoza** Date: **4/12/99**
Microscopist: **Patricia Lukens** Date Analyzed: **4/14/99** Checked by Patricia Lukens

Samples are collected and analyzed according to NIOSH 7400 (Issue 8/15/94) and/or State/OSHA Reference Methods via Phase Contrast Microscope (PCM) by NIOSH 582 trained, PAT or AIHA Registry participating analysts. Flow calibration is performed before and after sampling.
Intralaboratory Sr: (6.4 - 25.5 fibers/100 fields) 0.43; (25.6 -63.7 fibers/100 fields) 0.38; (63.8 -127.4 fibers/100 fields) 0.29; (>127.4 fibers/100 fields) 0.53
Interlaboratory Sr: 0.40

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LABORATORY #414

Log # T10110
Project # 75-99243.00
Number of Samples: 20

PO #: N/A

Job Location: **Clayton Office**

Abatement Firm: N/A

SAMPLE # CU903
SAMPLE TYPE: **Breathing Zone**
PUMP # 546229
PRIORITY: Regular

DATE: 4/9/99
CONTROLS: N/A / N/A / N/A

LOCATION: **Breathing zone**
OBSERVATIONS: **Material #3 (CF-3) - cut same 3 templates**

NAME: **Michael Krause** SS# CERT#

TIME			FLOW RATE (LPM)			VOLUME	Fibers/	Fiber Concentration		
		Total		Avg=		Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	11:43		Start:	4.08						
End:	11:58	15	End:	4.07	4.08	61	120 / 32	477.1	183,672	3.005

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU914
SAMPLE TYPE: **Area**
PUMP # 528754
PRIORITY: Regular

DATE: 4/9/99
CONTROLS: N/A / N/A / N/A

LOCATION: **6' from band saw cutting**
OBSERVATIONS:

NAME: SS# CERT#

TIME			FLOW RATE (LPM)			VOLUME	Fibers/	Fiber Concentration		
		Total		Avg=		Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	11:43		Start:	4.09						
End:	11:58	15	End:	4.08	4.09	61	56.5 / 100	71.3	27,465	0.448

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU904
SAMPLE TYPE: **Breathing Zone**
PUMP # 546229
PRIORITY: Regular

DATE: 4/9/99
CONTROLS: N/A / N/A / N/A

LOCATION: **Breathing zone**
Material #3 (CF-3)
OBSERVATIONS: **Bagging scrap material**
***Note: Start/stop times: Template scrap 12:00-12:08, Band saw scrap 15:58-16:06**

NAME: **Michael Krause** SS# CERT#

TIME			FLOW RATE (LPM)			VOLUME	Fibers/	Fiber Concentration		
		Total		Avg=		Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	*		Start:	4.09						
End:	*	16	End:	4.09	4.09	65	104 / 24	551.4	212,281	3.244

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

Microscope field area (mm²): 0.00785
Filter size (mm): 25 Effective Filter Area (mm²): 385
Control slide: 93-14 Result (f/mm²) 52.2

Detection Limits of Blank Corrected Fiber Count (Fibers/Field): 0.04
Blank 1: CU925 Blank 2: CU934
Blank Average: .5 / 100

Sampled by: **Michael Krause** Company: **Clayton Environmental Consultants**
Received by: **Rachel Melgoza** Date: **4/12/99**
Microscopist: **Patricia Lukens** Date Analyzed: **4/14/99** Checked by Patricia Lukens

Samples are collected and analyzed according to NIOSH 7400 (Issue 8/15/94) and/or State/OSHA Reference Methods via Phase Contrast Microscope (PCM) by NIOSH 582 trained, PAT or AIHA Registry participating analysts. Flow calibration is performed before and after sampling.
Intralaboratory Sr: (6.4 - 25.5 fibers/100 fields) 0.43; (25.6 -63.7 fibers/100 fields) 0.38; (63.8 -127.4 fibers/100 fields) 0.29; (>127.4 fibers/100 fields) 0.53
Interlaboratory Sr: 0.40

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AIR SAMPLE DATA

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LABORATORY #414

Log # T10110
Project # 75-99243.00
Number of Samples: 20

PO #: N/A

Job Location: **Clayton Office**

Abatement Firm: **N/A**

SAMPLE # CU915
SAMPLE TYPE: **Area**
PUMP # 546229
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS: N/A / N/A / N/A

LOCATION: **6' from band saw cutting**

OBSERVATIONS: ***Note: Start/stop times: Template scrap 12:00-12:08, Band saw scrap 15:58-16:06**

NAME: SS# CERT#

TIME			FLOW RATE (LPM)			VOLUME	Fibers/	Fiber Concentration		
		Total			Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	*		Start:	4.08						
End:	*	16	End:	4.08	4.08	65	58.5 / 100	73.9	28,446	**0.436**

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU906
SAMPLE TYPE: **Breathing Zone**
PUMP # 546229
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS: N/A / N/A / N/A

LOCATION: **Breathing zone**

OBSERVATIONS: **Cut sample #3, band saw, 58 cuts**

NAME: **Michael Krause** SS# CERT#

TIME			FLOW RATE (LPM)			VOLUME	Fibers/	Fiber Concentration		
		Total			Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	15:43		Start:	4.10						
End:	15:56	13	End:	4.10	4.10	53	101 / 114	112.2	43,207	**0.811**

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU926
SAMPLE TYPE: **Area**
PUMP # 528754
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS: N/A / N/A / N/A

LOCATION: **6' from band saw cutting**

OBSERVATIONS:

NAME: SS# CERT#

TIME			FLOW RATE (LPM)			VOLUME	Fibers/	Fiber Concentration		
		Total			Avg=	Liters=	Fields	Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
Start:	15:43		Start:	4.10						
End:	15:56	13	End:	4.08	4.09	53	102 / 105	123.1	47,398	**0.891**

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

Microscope field area (mm²): 0.00785
Filter size (mm): 25 Effective Filter Area (mm²): 385
Control slide: 93-14 Result (f/mm²) 52.2

Detection Limits of Blank Corrected Fiber Count (Fibers/Field): 0.04
Blank 1: CU925 Blank 2: CU934
Blank Average: .5 / 100

Sampled by: **Michael Krause** Company: **Clayton Environmental Consultants**
Received by: **Rachel Melgoza** Date: **4/12/99**
Microscopist: **Patricia Lukens** Date Analyzed: **4/14/99** Checked by Patricia Lukens

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Intralaboratory Sr: (6.4 - 25.5 fibers/100 fields) 0.43; (25.6 -63.7 fibers/100 fields) 0.38; (63.8 -127.4 fibers/100 fields) 0.29; (>127.4 fibers/100 fields) 0.53
Interlaboratory Sr: 0.40

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LABORATORY #414

Log # T10110
Project # 75-99243.00
Number of Samples: 20

PO #: N/A

Job Location: **Clayton Office**

Abatement Firm: **N/A**

SAMPLE # CU925
SAMPLE TYPE: **Blank**
PUMP #
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS:
N/A
N/A
N/A

LOCATION: **Blank**
OBSERVATIONS:

NAME: SS# CERT#

TIME	FLOW RATE (LPM)	VOLUME	Fibers/ Fields	Fiber Concentration		
Start: Total	Start: Avg=	Liters=		Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
End:	End:		1 / 100	< 5.0	< 2,000	< ?

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

SAMPLE # CU934
SAMPLE TYPE: **Blank**
PUMP #
PRIORITY: Regular

DATE: **4/9/99**
CONTROLS:
N/A
N/A
N/A

LOCATION: **Blank**
OBSERVATIONS:

NAME: SS# CERT#

TIME	FLOW RATE (LPM)	VOLUME	Fibers/ Fields	Fiber Concentration		
Start: Total	Start: Avg=	Liters=		Fibers/ mm²	Fibers/ Filter	*FIBERS/ CC:
End:	End:		0 / 100	< 5.0	< 2,000	< ?

Method: **NIOSH Criteria Doc. No. 77-152** Limit of Detection: **5** **2,000**

Footnote: Count Criteria: Fibers longer than 10 um in length with length-to-width ratio greater than or equal to 3:1.

Microscope field area (mm²): 0.00785
Filter size (mm): 25 Effective Filter Area (mm²): 385
Control slide: 93-14 Result (f/mm²) 52.2

Detection Limits of Blank Corrected Fiber Count (Fibers/Field): 0.04
Blank 1: CU925 Blank 2: CU934
Blank Average: .5 / 100

Sampled by: **Michael Krause** Company: **Clayton Environmental Consultants**
Received by: **Rachel Melgoza** Date: **4/12/99**
Microscopist: **Patricia Lukens** Date Analyzed: **4/14/99** Checked by Patricia Lukens

Samples are collected and analyzed according to NIOSH 7400 (Issue 8/15/94) and/or State/OSHA Reference Methods via Phase Contrast Microscope (PCM) by NIOSH 582 trained, PAT or AIHA Registry participating analysts. Flow calibration is performed before and after sampling.
Intralaboratory Sr: (6.4 - 25.5 fibers/100 fields) 0.43; (25.6 -63.7 fibers/100 fields) 0.38; (63.8 -127.4 fibers/100 fields) 0.29; (>127.4 fibers/100 fields) 0.53
Interlaboratory Sr: 0.40

APPENDIX C

TEM FIBER ANALYSIS REPORT

Atlanta Regional Office

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Suite 300
Kennesaw, GA 30144
(770) 499-7500
(800) 252-9919
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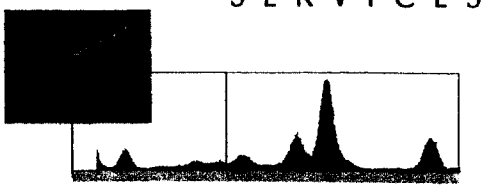

May 28, 1999

Mr. Mike Krause
CLAYTON ENVIRONMENTAL CONSULTANTS
4636 E. Marginal Way, S. Suite 215
Seattle, WA 98134

Client Reference: [redacted]
Clayton Reference AT05922a (R1/May 27,1999)

Dear Mr. Krause:

Attached is our analytical laboratory report for the samples submitted on April 15, 1999. Enclosed is a copy of the chain-of-custody record to acknowledge receipt of these samples. The results apply only to the samples analyzed in this project.

Please note that any unused portion of the samples will be discarded after 90 days, on July 15, 1999 unless you have requested otherwise.

We appreciate the opportunity to assist you. If you have any questions concerning this report, please contact me at (770) 499-7500.

Sincerely,

Alan M. Segrave, P.G.
Director, Laboratory Services
Atlanta Regional Office

AMS/ams

Attachments

CARBON FIBER CONCENTRATION AND SIZE DISTRIBUTION FOR [redacted]

SUMMARY

The objective of this study was to determine the total and respirable concentration of carbon fibers on (9) air samples submitted on April 15, 1999. The samples were analyzed by the World Health Organization (WHO) counting rules using transmission electron microscopy (TEM) at 15,000X. One hundred carbon fibers were sized (length and width) for each sample and are enclosed in tabular form. Fibers were identified by TEM and SEM utilizing light element energy dispersive x-ray analysis (EDAX) to determine elemental composition. All fibers observed in each sample were composed of carbon.

PREPARATION AND ANALYSIS OF SAMPLES

Each sample was prepared for TEM analysis by the direct preparation method and placed onto copper grids for examination. One hundred fibers (or a minimum of 20 grid openings) were counted and the length and width recorded. SEM analysis was performed using an ISI DS-130 SEM at 2 –25 KeV and a Kevex light element detector.

CONCENTRATION OF CARBON FIBERS (FIBERS PER CUBIC CENTIMETER)

CLIENT ID	*WHO TOTAL* CONCENTRATION*	*WHO** RESPIRABLE CONCENTRATION*
CU922	4.5	3.9
CU931	11.0	10.5
CU935	0.46	0.37
CU901	8.9	8.7
CU913	6.6	6.14
CU944	0.95	0.86
CU903	10.0	9.62
CU904	7.1	6.58
CU906	1.4	1.4

*Aspect ratio of ≥3:1, with no restrictions on length and width.
**Aspect ratio ≥ 3:1, greater than 5 micrometers long and less than 3 micrometers wide.

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CARBON FIBER CONCENTRATION AND SIZE DISTRIBUTION FOR [redacted]

LENGTH DISTRIBUTION (%)

SIZE Micron	CU922	CU931	CU935	CU901	CU913	CU944	CU903	CU904	CU906
<5	11	16	25	20	6	6	6	15	0
>5 - <10	16	25	18	24	23	17	17	22	31
>10 - <15	15	19	18	17	17	16	22	17	14
>15 - <20	9	13	8	10	14	17	21	16	14
>20	49	27	31	29	40	44	34	30	41

COMPANY SANITIZED

WIDTH DISTRIBUTION (%)

SIZE Micron	CU922	CU931	CU935	CU901	CU913	CU944	CU903	CU904	CU906
0 - <0.25	1	3	19	1	0	47	0	2	0
>0.25 - <1.0	30	45	19	43	24	0	36	30	28
>1.0 - <1.5	22	17	19	18	28	0	26	20	30
>1.5 - <2.0	14	15	6	14	13	0	4	10	20
>2.0	33	20	37	24	35	53	34	38	22

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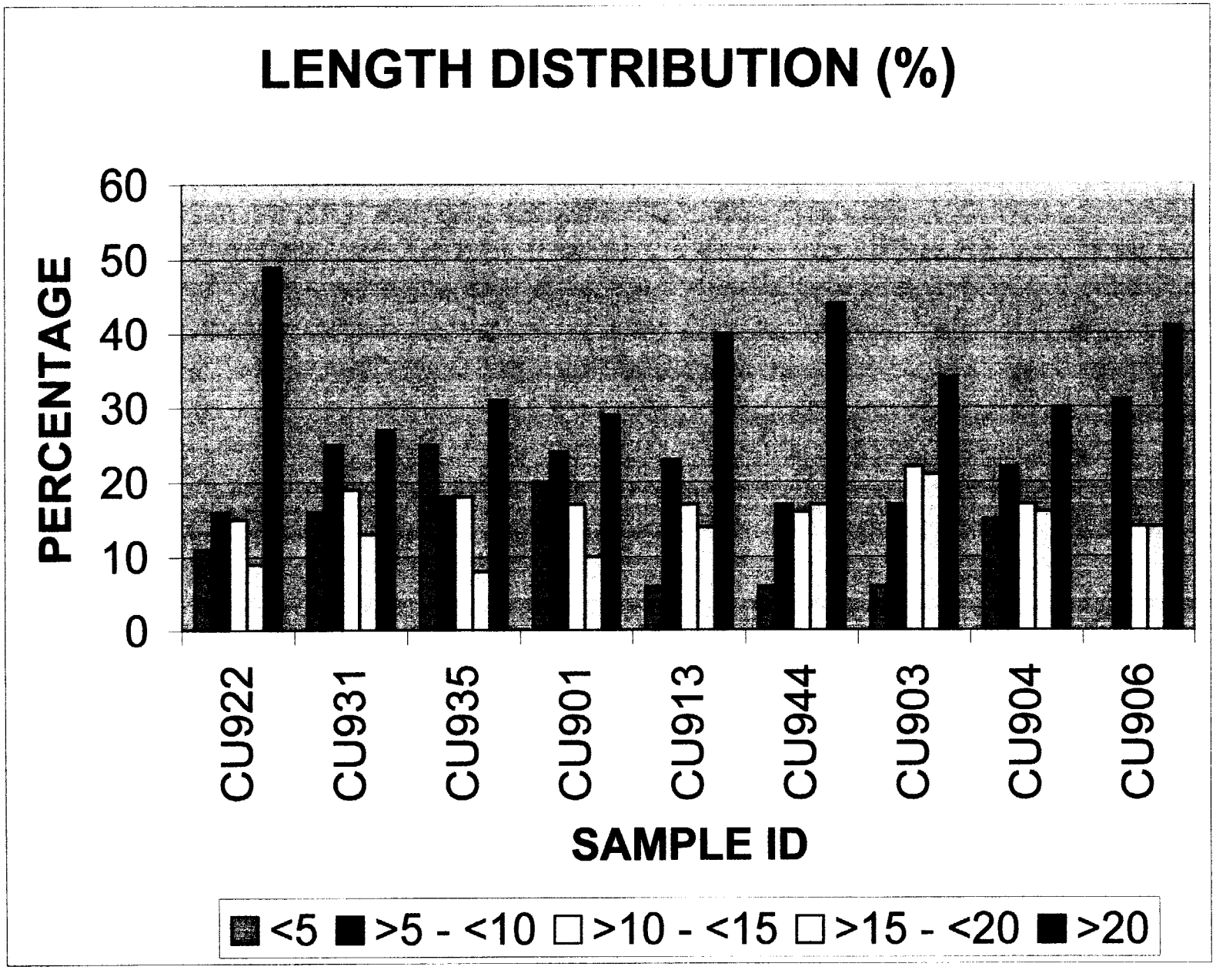

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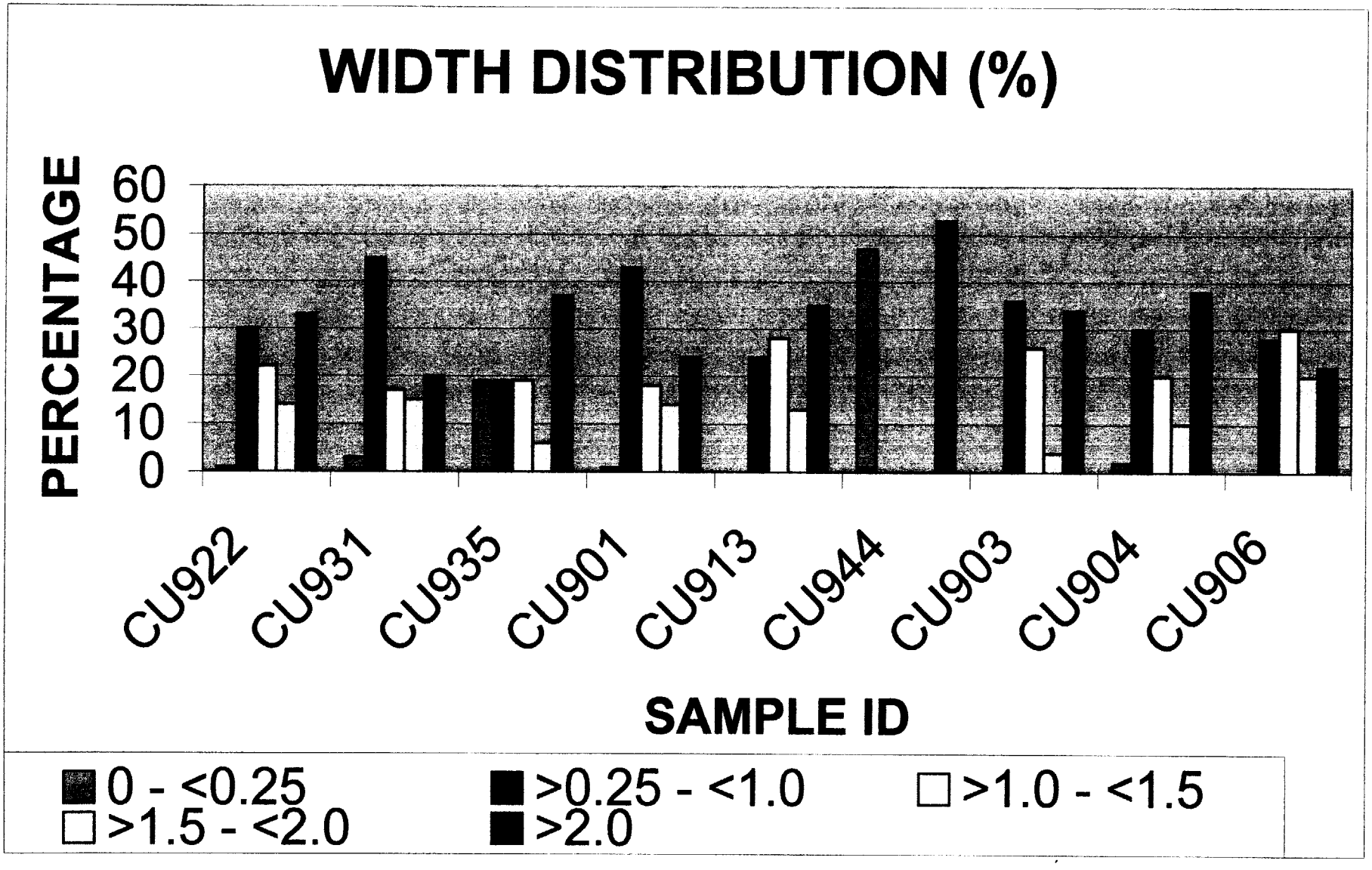
SERVICES



Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00/

Clayton Order Number: AT05922

Sample Type: MCEF, 25 mm, 0.80um
Analytical Method: TEM\EDS
Analyst: TWS
Microscope: Philips CM12 (Scope 1)
Magnification: 14,556X
Grid Opening Size: 0.0091mm^2

Date Sampled: 04/08/99
Date Received: 04/15/99
Date Analyzed: 04/21/99
Redeposition Filter: --
Effective Filter Area: 385 mm^2

Lab Sample No.	Client Sample Identification	Air Volume (L)	Grid Openings Examined	Fibers Counted: Carbon Fibers	Fibers Counted: Total Fibers	Reporting Limit (f/mm^2)	Total (f/mm^2)	Total (f/cc)
AT05922-1	CU922	82.3	12	105	105	9.2	960	4.5
AT05922-2	CU931	53.2	8	110	110	14	1500	11
AT05922-3	CU935	74.0	20	16	16	5.5	88	0.46
AT05922-4	CU901	61.0	8	103	103	14	1400	8.9
AT05922-5	CU913	53.1	12	100	100	9.2	920	6.6
AT05922-6	CU944	61.6	37	51	51	3.	150	0.95
AT05922-7	CU903	61.1	7	105	105	16	1600	10
AT05922-8	CU904	65.4	10	109	109	11	1200	7.1
AT05922-9	CU906	53.3	20	36	36	5.5	200	1.4

Clayton
LABORATORY
SERVICES

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00

Clayton Order Number: AT05922

Sample Type: MCEF, 25 mm, 0.80um
Analytical Method: TEM\EDS
Analyst: KRP
Microscope: Philips CM12 (Scope 2)
Magnification: 14,464X
Grid Opening Size: 0.0091mm^2

Date Sampled: 04/09/99
Date Received: 04/15/99
Date Analyzed: 04/21/99
Redeposition Filter: --
Effective Filter Area: 385 mm^2

Lab Sample No.	Client Sample Identification	Air Volume (L)	Grid Openings Examined	Fibers Counted: Carbon Fibers	Fibers Counted: Total Fibers	Reporting Limit (f/mm^2)	Total (f/mm^2)	Total (f/cc)

MCEF: Mixed Cellulose Ester Filter

General Notes:
--: Information not available or not applicable.
< : Result less than the indicated limit of detection (LOD).
* : Sample not analyzed per client request.

Analyst(s)/Date: KRP / 4/22/99

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU922 Method: TEM\EDS

Lab Sample No: AT05922-1 Analyst: TWS

id	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
A1	C4A	1	1	5.8	1.4	Fiber	Carbon Fiber	
A1			2	16	1.4	Fiber	Carbon Fiber	
A1			3	21	5.4	Fiber	Carbon Fiber	
A1			4	18	3.8	Fiber	Carbon Fiber	
A1			5	6.5	1.7	Fiber	Carbon Fiber	
A1			6	11	2.1	Fiber	Carbon Fiber	
A1			7	2.2	.69	Fiber	Carbon Fiber	
A1			8	7.1	1.4	Fiber	Carbon Fiber	
A1	C4C	2	9	75	1.4	Fiber	Carbon Fiber	
A1			10	27	1.4	Fiber	Carbon Fiber	
A1			11	8.9	.89	Fiber	Carbon Fiber	
A1			12	21	1.4	Fiber	Carbon Fiber	
A1			13	48	4.1	Fiber	Carbon Fiber	
A1			14	48	4.1	Fiber	Carbon Fiber	
A1	E4A	3	15	14	1.7	Fiber	Carbon Fiber	
A1			16	27	3.8	Fiber	Carbon Fiber	
			17	48	1.2	Fiber	Carbon Fiber	
A1			18	27	1.7	Fiber	Carbon Fiber	
A1			19	16	.69	Fiber	Carbon Fiber	
A1			20	27	1	Fiber	Carbon Fiber	
A1			21	48	.69	Fiber	Carbon Fiber	
A1			22	32	1	Fiber	Carbon Fiber	
A1			23	91	1.7	Fiber	Carbon Fiber	
A1			24	24	2.1	Fiber	Carbon Fiber	
A1			25	16	1	Fiber	Carbon Fiber	
A1			26	2.1	.69	Fiber	Carbon Fiber	
A1			27	37	2.7	Fiber	Carbon Fiber	
A1			28	37	1.7	Fiber	Carbon Fiber	
A1			29	6.7	1.7	Fiber	Carbon Fiber	
A1			30	4.8	1	Fiber	Carbon Fiber	
A1			31	25	3.1	Fiber	Carbon Fiber	
A1			32	6.4	.34	Fiber	Carbon Fiber	
A1			33	15	.27	Fiber	Carbon Fiber	
A1	E4C	4	34	58	7.6	Fiber	Carbon Fiber	
A1			35	27	2.1	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU922 Method: TEM\EDS

Lab Sample No: AT05922-1 Analyst: TWS

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
A1			36	3.4	.69	Fiber	Carbon Fiber	
A1			37	24	1.5	Fiber	Carbon Fiber	
A1			38	80	1.7	Fiber	Carbon Fiber	
A1	F5A	5	39	3.1	1.2	Fiber	Carbon Fiber	
A1			40	4.1	1	Fiber	Carbon Fiber	
A1			41	5.8	1.4	Fiber	Carbon Fiber	
A1			42	32	1.7	Fiber	Carbon Fiber	
A1			43	29	1.4	Fiber	Carbon Fiber	
A1			44	85	2.1	Fiber	Carbon Fiber	
A1			45	9.1	.69	Fiber	Carbon Fiber	
A1			46	5.5	1.7	Fiber	Carbon Fiber	
A1			47	12	2.4	Fiber	Carbon Fiber	
A1			48	16	.69	Fiber	Carbon Fiber	
A1			49	24	.69	Fiber	Carbon Fiber	
A1			50	12	3.8	Fiber	Carbon Fiber	
A1			51	7.2	1.4	Fiber	Carbon Fiber	
A1			52	14	.55	Fiber	Carbon Fiber	
A2	C4A	6	53	12	2.6	Fiber	Carbon Fiber	
			54	54	2.4	Fiber	Carbon Fiber	
A2			55	100	2.1	Fiber	Carbon Fiber	
A2			56	66	2.1	Fiber	Carbon Fiber	
A2			57	4.6	.41	Fiber	Carbon Fiber	
A2			58	91	4.5	Fiber	Carbon Fiber	
A2			59	34	1.7	Fiber	Carbon Fiber	
A2			60	22	1	Fiber	Carbon Fiber	
A2			61	34	6.9	Fiber	Carbon Fiber	
A2			62	32	1.4	Fiber	Carbon Fiber	
A2			63	7	1.4	Fiber	Carbon Fiber	
A2			64	3.1	2.4	Fiber	Carbon Fiber	
A2	C4C	7	65	13	.69	Fiber	Carbon Fiber	
A2			66	64	1.4	Fiber	Carbon Fiber	
A2			67	43	7.9	Fiber	Carbon Fiber	
A2			68	14	1.4	Fiber	Carbon Fiber	
A2	E4A	8	69	37	1.4	Fiber	Carbon Fiber	
A2			70	38	2.1	Fiber	Carbon Fiber	
A2			71	11	1.2	Fiber	Carbon Fiber	
A2			72	53	2.2	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU922 Method: TEM\EDS

Lab Sample No: AT05922-1 Analyst: TWS

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
A2			73	20	.69	Fiber	Carbon Fiber	
A2			74	18	1	Fiber	Carbon Fiber	
A2			75	11	1	Fiber	Carbon Fiber	
A2			76	21	3.4	Fiber	Carbon Fiber	
A2			77	3.4	1	Fiber	Carbon Fiber	
A2			78	69	2.4	Fiber	Carbon Fiber	
A2			79	11	1.4	Fiber	Carbon Fiber	
A2	E4C	9	80	7.7	1.7	Fiber	Carbon Fiber	
A2			81	33	3.8	Fiber	Carbon Fiber	
A2			82	11	2.4	Fiber	Carbon Fiber	
A2			83	69	2.7	Fiber	Carbon Fiber	
A2			84	5.8	1	Fiber	Carbon Fiber	
A2			85	21	2.7	Fiber	Carbon Fiber	
A2			86	3.1	.82	Fiber	Carbon Fiber	
A2			87	5.8	1.7	Fiber	Carbon Fiber	
A2	F4A	10	88	31	7.8	Fiber	Carbon Fiber	
A2	F4C	11	89	11	1	Fiber	Carbon Fiber	
A2			90	1.4	.14	Fiber	Carbon Fiber	
			91	27	2.4	Fiber	Carbon Fiber	
A2			92	46	1.5	Fiber	Carbon Fiber	
A2			93	9.5	1.4	Fiber	Carbon Fiber	
A2			94	8.6	.55	Fiber	Carbon Fiber	
A2			95	27	1	Fiber	Carbon Fiber	
A2			96	21	1.2	Fiber	Carbon Fiber	
A2			97	16	1	Fiber	Carbon Fiber	
A2			98	10	1.7	Fiber	Carbon Fiber	
A2	G4A	12	99	48	2.2	Fiber	Carbon Fiber	
A2			100	3.4	1.4	Fiber	Carbon Fiber	
A2			101	7.2	1	Fiber	Carbon Fiber	
A2			102	48	1	Fiber	Carbon Fiber	
A2			103	12	2.1	Fiber	Carbon Fiber	
A2			104	13	3.4	Fiber	Carbon Fiber	
A2			105	19	1.7	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU931 Method: TEM\EDS

Lab Sample No: AT05922-2 Analyst: TWS

id	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
B1	C4A	1	1	29	1.8	Fiber	Carbon Fiber	
B1			2	1	.27	Fiber	Carbon Fiber	
B1			3	13	1.2	Fiber	Carbon Fiber	
B1			4	6	1.2	Fiber	Carbon Fiber	
B1			5	59	4.1	Fiber	Carbon Fiber	
B1			6	1.4	.27	Fiber	Carbon Fiber	
B1			7	34	2.4	Fiber	Carbon Fiber	
B1			8	7.8	1	Fiber	Carbon Fiber	
B1			9	10	1.4	Fiber	Carbon Fiber	
B1	C4C	2	10	13	2.4	Fiber	Carbon Fiber	
B1			11	64	3.6	Fiber	Carbon Fiber	
B1			12	6.7	2.1	Fiber	Carbon Fiber	
B1			13	16	.69	Fiber	Carbon Fiber	
B1			14	3.1	.34	Fiber	Carbon Fiber	
B1			15	5.8	1.2	Fiber	Carbon Fiber	
B1			16	16	1	Fiber	Carbon Fiber	
			17	3.1	.69	Fiber	Carbon Fiber	
B1			18	34	1.4	Fiber	Carbon Fiber	
B1			19	7.6	.55	Fiber	Carbon Fiber	
B1			20	23	1.4	Fiber	Carbon Fiber	
B1			21	30	2.1	Fiber	Carbon Fiber	
B1			22	18	2.2	Fiber	Carbon Fiber	
B1			23	6.2	1.7	Fiber	Carbon Fiber	
B1			24	4.8	.34	Fiber	Carbon Fiber	
B1			25	5.4	1.2	Fiber	Carbon Fiber	
B1	E4A	3	26	8.9	1	Fiber	Carbon Fiber	
B1			27	11	1.4	Fiber	Carbon Fiber	
B1			28	11	1.9	Fiber	Carbon Fiber	
B1			29	9.4	1	Fiber	Carbon Fiber	
B1			30	10	1.2	Fiber	Carbon Fiber	
B1			31	19	3.1	Fiber	Carbon Fiber	
B1			32	33	2.7	Fiber	Carbon Fiber	
B1			33	44	1	Fiber	Carbon Fiber	
B1			34	12	2.1	Fiber	Carbon Fiber	
B1			35	3.1	.55	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU931 Method: TEM\EDS

Lab Sample No: AT05922-2 Analyst: TWS

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
B1			36	6.9	1.9	Fiber	Carbon Fiber	
B1			37	2.1	.21	Fiber	Carbon Fiber	
B1			38	21	1.7	Fiber	Carbon Fiber	
B1			39	3.1	.41	Fiber	Carbon Fiber	
B1			40	3.2	.41	Fiber	Carbon Fiber	
B1	E4C	4	41	8.8	.21	Fiber	Carbon Fiber	
B1			42	19	1.4	Fiber	Carbon Fiber	
B1			43	7.2	.55	Fiber	Carbon Fiber	
B1			44	3.4	1.1	Fiber	Carbon Fiber	
B1			45	27	1.2	Fiber	Carbon Fiber	
B1			46	21	.69	Fiber	Carbon Fiber	
B1			47	5.5	.55	Fiber	Carbon Fiber	
B1			48	8.8	.82	Fiber	Carbon Fiber	
B1			49	16	.55	Fiber	Carbon Fiber	
B1			50	3.1	.82	Fiber	Carbon Fiber	
B1			51	5.4	.41	Fiber	Carbon Fiber	
B1			52	16	1	Fiber	Carbon Fiber	
B2	C4A	5	53	13	2.1	Fiber	Carbon Fiber	
			54	8.4	.69	Fiber	Carbon Fiber	
B2			55	12	.48	Fiber	Carbon Fiber	
B2			56	27	1.7	Fiber	Carbon Fiber	
B2			57	11	2.1	Fiber	Carbon Fiber	
B2			58	13	2.1	Fiber	Carbon Fiber	
B2			59	48	1.7	Fiber	Carbon Fiber	
B2			60	16	.96	Fiber	Carbon Fiber	
B2			61	5.4	.69	Fiber	Carbon Fiber	
B2			62	13	1	Fiber	Carbon Fiber	
B2	C4C	6	63	11	1	Fiber	Carbon Fiber	
B2			64	5.2	1	Fiber	Carbon Fiber	
B2			65	3.4	.41	Fiber	Carbon Fiber	
B2			66	37	2.4	Fiber	Carbon Fiber	
B2			67	53	2.3	Fiber	Carbon Fiber	
B2			68	12	1	Fiber	Carbon Fiber	
B2			69	2.5	.14	Fiber	Carbon Fiber	
B2			70	12	1	Fiber	Carbon Fiber	
B2			71	5.4	.48	Fiber	Carbon Fiber	
B2			72	32	1.7	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU931 Method: TEM\EDS

Lab Sample No: AT05922-2 Analyst: TWS

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
B2			73	2.7	.41	Fiber	Carbon Fiber	
B2			74	4.1	.34	Fiber	Carbon Fiber	
B2			75	5.2	1.4	Fiber	Carbon Fiber	
B2			76	43	1.4	Fiber	Carbon Fiber	
B2			77	13	1.3	Fiber	Carbon Fiber	
B2			78	7.6	1	Fiber	Carbon Fiber	
B2			79	7.2	.69	Fiber	Carbon Fiber	
B2			80	16	2.1	Fiber	Carbon Fiber	
B2			81	7.6	1.7	Fiber	Carbon Fiber	
B2			82	9.5	2.1	Fiber	Carbon Fiber	
B2	E4A	7	83	26	1	Fiber	Carbon Fiber	
B2			84	4.8	1.4	Fiber	Carbon Fiber	
B2			85	16	.69	Fiber	Carbon Fiber	
B2			86	16	1.7	Fiber	Carbon Fiber	
B2			87	21	3.8	Fiber	Carbon Fiber	
B2			88	16	1.2	Fiber	Carbon Fiber	
B2			89	5.8	1	Fiber	Carbon Fiber	
B2			90	16	1.8	Fiber	Carbon Fiber	
			91	16	2.1	Fiber	Carbon Fiber	
B2			92	31	1	Fiber	Carbon Fiber	
B2			93	11	2.1	Fiber	Carbon Fiber	
B2			94	37	4.1	Fiber	Carbon Fiber	
B2			95	12	.69	Fiber	Carbon Fiber	
B2	E4C	8	96	6.2	1.2	Fiber	Carbon Fiber	
B2			97	11	.69	Fiber	Carbon Fiber	
B2			98	21	1.7	Fiber	Carbon Fiber	
B2			99	27	1.7	Fiber	Carbon Fiber	
B2			100	8.1	.82	Fiber	Carbon Fiber	
B2			101	37	1.7	Fiber	Carbon Fiber	
B2			102	37	1.7	Fiber	Carbon Fiber	
B2			103	45	1	Fiber	Carbon Fiber	
B2			104	12	1.7	Fiber	Carbon Fiber	
B2			105	10	2.1	Fiber	Carbon Fiber	
B2			106	27	1.2	Fiber	Carbon Fiber	
B2			107	21	.82	Fiber	Carbon Fiber	
B2			108	4.6	.27	Fiber	Carbon Fiber	
B2			109	4.6	.82	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU931

Method: TEM\EDS

Lab Sample No: AT05922-2

Analyst: TWS

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
B2			110	32	3.8	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU935

Method: TEM\EDS

Lab Sample No: AT05922-3

Analyst: TWS

id	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
C1	C4A	1	1	21	4.8	Fiber	Carbon Fiber	
C1	C4C	2	NSD					
C1	E4A	3	2	12	1.4	Fiber	Carbon Fiber	
C1			3	34	2.6	Fiber	Carbon Fiber	
C1	E4C	4	NSD					
C1	F4A	5	NSD					
C1	F4C	6	4	48	4.8	Fiber	Carbon Fiber	
C1	G4A	7	NSD					
C1	G4C	8	NSD					
C1	H4A	9	5	32	2.1	Fiber	Carbon Fiber	
C1			6	3.8	.69	Fiber	Carbon Fiber	
C1	H4C	10	7	.69	.069	Fiber	Carbon Fiber	
C2	C4A	11	8	13	3.4	Fiber	Carbon Fiber	
C2	C4C	12	NSD					
C2	E4A	13	NSD					
C2	E4C	14	NSD					
C2	F4A	15	9	32	3.8	Fiber	Carbon Fiber	
C2			10	7.6	.69	Fiber	Carbon Fiber	
C2			11	9.3	2.7	Fiber	Carbon Fiber	
C2	F4C	16	12	10	1.4	Fiber	Carbon Fiber	
C2			13	8.1	1	Fiber	Carbon Fiber	
C2	G4A	17	NSD					
C2	G4C	18	14	3.4	.14	Fiber	Carbon Fiber	
C2	H4A	19	NSD					
C2	H4C	20	15	2.1	.14	Fiber	Carbon Fiber	
C2			16	19	1.4	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU901 Method: TEM\EDS

Lab Sample No: AT05922-4 Analyst: TWS

id	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
D1	E4A	1	1	43	1.5	Fiber	Carbon Fiber	
D1			2	3.4	1	Fiber	Carbon Fiber	
D1			3	58	2.7	Fiber	Carbon Fiber	
D1			4	18	1	Fiber	Carbon Fiber	
D1			5	59	1	Fiber	Carbon Fiber	
D1			6	4.8	.34	Fiber	Carbon Fiber	
D1			7	11	1.4	Fiber	Carbon Fiber	
D1			8	9.6	1.4	Fiber	Carbon Fiber	
D1			9	25	1.4	Fiber	Carbon Fiber	
D1			10	12	1	Fiber	Carbon Fiber	
D1			11	5.8	1.4	Fiber	Carbon Fiber	
D1			12	3.8	.48	Fiber	Carbon Fiber	
D1			13	12	1	Fiber	Carbon Fiber	
D1			14	12	2.1	Fiber	Carbon Fiber	
D1			15	4.8	.82	Fiber	Carbon Fiber	
D1			16	18	1.7	Fiber	Carbon Fiber	
			17	8.5	2.3	Fiber	Carbon Fiber	
D1	E4C	2	18	3.4	1	Fiber	Carbon Fiber	
D1			19	11	2.1	Fiber	Carbon Fiber	
D1			20	11	.69	Fiber	Carbon Fiber	
D1			21	3.8	1	Fiber	Carbon Fiber	
D1			22	4.1	.55	Fiber	Carbon Fiber	
D1			23	2.4	.69	Fiber	Carbon Fiber	
D1			24	2.7	.82	Fiber	Carbon Fiber	
D1	F4A	3	25	8.8	1	Fiber	Carbon Fiber	
D1			26	12	1.7	Fiber	Carbon Fiber	
D1			27	12	.89	Fiber	Carbon Fiber	
D1			28	110	1.2	Fiber	Carbon Fiber	
D1			29	21	2.1	Fiber	Carbon Fiber	
D1			30	38	1.7	Fiber	Carbon Fiber	
D1			31	16	2.4	Fiber	Carbon Fiber	
D1			32	47	4.1	Fiber	Carbon Fiber	
D1			33	12	1.4	Fiber	Carbon Fiber	
D1			34	37	1	Fiber	Carbon Fiber	
D1			35	23	3.4	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU901

Method: TEM\EDS

Lab Sample No: AT05922-4

Analyst: TWS

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
D1			36	14	2.1	Fiber	Carbon Fiber	
D1			37	11	1.7	Fiber	Carbon Fiber	
D1			38	19	2.7	Fiber	Carbon Fiber	
D1			39	29	1.7	Fiber	Carbon Fiber	
D1	F4C	4	40	.76	.069	Fiber	Carbon Fiber	
D1			41	11	1	Fiber	Carbon Fiber	
D1			42	5.8	1.4	Fiber	Carbon Fiber	
D1			43	18	2.4	Fiber	Carbon Fiber	
D1			44	6.2	1.4	Fiber	Carbon Fiber	
D1			45	37	.82	Fiber	Carbon Fiber	
D1			46	23	.41	Fiber	Carbon Fiber	
D1			47	58	2.1	Fiber	Carbon Fiber	
D1			48	6.5	1.6	Fiber	Carbon Fiber	
D1			49	48	2.4	Fiber	Carbon Fiber	
D1			50	14	2.1	Fiber	Carbon Fiber	
D2	E4A	5	51	3.4	1	Fiber	Carbon Fiber	
D2			52	21	1.4	Fiber	Carbon Fiber	
D2			53	58	3.1	Fiber	Carbon Fiber	
			54	8.4	.69	Fiber	Carbon Fiber	
D2			55	16	.69	Fiber	Carbon Fiber	
D2			56	13	1	Fiber	Carbon Fiber	
D2			57	32	2.4	Fiber	Carbon Fiber	
D2			58	24	1	Fiber	Carbon Fiber	
D2			59	5.8	1.4	Fiber	Carbon Fiber	
D2			60	11	1	Fiber	Carbon Fiber	
D2			61	3.4	.89	Fiber	Carbon Fiber	
D2			62	16	1.8	Fiber	Carbon Fiber	
D2			63	2.1	.34	Fiber	Carbon Fiber	
D2			64	1.9	.27	Fiber	Carbon Fiber	
D2			65	1.1	.27	Fiber	Carbon Fiber	
D2	E4C	6	66	23	2.1	Fiber	Carbon Fiber	
D2			67	4.5	.34	Fiber	Carbon Fiber	
D2			68	5.6	.27	Fiber	Carbon Fiber	
D2			69	2.3	.41	Fiber	Carbon Fiber	
D2			70	5.8	1	Fiber	Carbon Fiber	
D2			71	22	1.2	Fiber	Carbon Fiber	
D2			72	27	6	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU901

Method: TEM\EDS

Lab Sample No: AT05922-4

Analyst: TWS

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
D2			73	8.8	1.7	Fiber	Carbon Fiber	
D2			74	12	1.7	Fiber	Carbon Fiber	
D2			75	5.5	.41	Fiber	Carbon Fiber	
D2			76	8.2	1.7	Fiber	Carbon Fiber	
D2			77	5.5	1	Fiber	Carbon Fiber	
D2			78	4.1	.27	Fiber	Carbon Fiber	
D2			79	8.5	1.4	Fiber	Carbon Fiber	
D2			80	6.5	1.4	Fiber	Carbon Fiber	
D2			81	6.5	1.4	Fiber	Carbon Fiber	
D2			82	16	2.2	Fiber	Carbon Fiber	
D2			83	2.5	.69	Fiber	Carbon Fiber	
D2	F4A	7	84	21	2.1	Fiber	Carbon Fiber	
D2			85	8.1	2.1	Fiber	Carbon Fiber	
D2			86	8.2	1	Fiber	Carbon Fiber	
D2			87	16	1.4	Fiber	Carbon Fiber	
D2			88	11	1.4	Fiber	Carbon Fiber	
D2			89	34	2.4	Fiber	Carbon Fiber	
D2			90	27	1.7	Fiber	Carbon Fiber	
			91	5.5	1.7	Fiber	Carbon Fiber	
D2			92	8.1	1.4	Fiber	Carbon Fiber	
D2			93	5.2	1.7	Fiber	Carbon Fiber	
D2	F4C	8	94	17	2.1	Fiber	Carbon Fiber	
D2			95	8.2	2.6	Fiber	Carbon Fiber	
D2			96	37	2.6	Fiber	Carbon Fiber	
D2			97	61	.69	Fiber	Carbon Fiber	
D2			98	4.1	.76	Fiber	Carbon Fiber	
D2			99	37	1.7	Fiber	Carbon Fiber	
D2			100	23	.55	Fiber	Carbon Fiber	
D2			101	22	.69	Fiber	Carbon Fiber	
D2			102	7.2	.55	Fiber	Carbon Fiber	
D2			103	2.4	.55	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU913

Method: TEM\EDS

Lab Sample No: AT05922-5

Analyst: KRP

id	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
A5	B5A	1	1	42	2.1	Fiber	Carbon Fiber	
A5			2	8.6	2.4	Fiber	Carbon Fiber	
A5			3	50	1.4	Fiber	Carbon Fiber	
A5			4	27	1.4	Fiber	Carbon Fiber	
A5			5	24	4.8	Fiber	Carbon Fiber	
A5			6	16	2.3	Fiber	Carbon Fiber	
A5			7	41	2.1	Fiber	Carbon Fiber	
A5			8	8.3	1.4	Fiber	Carbon Fiber	
A5			9	41	1.7	Fiber	Carbon Fiber	
A5	B5C	2	10	13	1.4	Fiber	Carbon Fiber	
A5			11	8.6	1.7	Fiber	Carbon Fiber	
A5			12	10	2.1	Fiber	Carbon Fiber	
A5			13	32	1.7	Fiber	Carbon Fiber	
A5			14	17	1.7	Fiber	Carbon Fiber	
A5			15	10	1.7	Fiber	Carbon Fiber	
A5	C5A	3	16	5.2	.69	Fiber	Carbon Fiber	
			17	9	1	Fiber	Carbon Fiber	
A5			18	21	6.2	Fiber	Carbon Fiber	
A5			19	22	2.2	Fiber	Carbon Fiber	
A5			20	11	1.4	Fiber	Carbon Fiber	
A5			21	32	2.4	Fiber	Carbon Fiber	
A5			22	26	2.3	Fiber	Carbon Fiber	
A5			23	7.3	1.4	Fiber	Carbon Fiber	
A5			24	3.8	.83	Fiber	Carbon Fiber	
A5			25	4.1	1	Fiber	Carbon Fiber	
A5			26	20	1.4	Fiber	Carbon Fiber	
A5			27	35	1.4	Fiber	Carbon Fiber	
A5			28	15	1.2	Fiber	Carbon Fiber	
A5	C5C	4	29	77	1.4	Fiber	Carbon Fiber	
A5			30	16	5.2	Fiber	Carbon Fiber	
A5			31	80	5.3	Fiber	Carbon Fiber	
A5			32	50	1.5	Fiber	Carbon Fiber	
A5			33	12	.9	Fiber	Carbon Fiber	
A5			34	5.2	1.2	Fiber	Carbon Fiber	
A5			35	4.5	.69	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU913

Method: TEM\EDS

Lab Sample No: AT05922-5

Analyst: KRP

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
A5			36	9.3	2.1	Fiber	Carbon Fiber	
A5			37	30	3.2	Fiber	Carbon Fiber	
A5			38	11	3	Fiber	Carbon Fiber	
A5			39	8.6	1.7	Fiber	Carbon Fiber	
A5	E5A	5	40	23	.83	Fiber	Carbon Fiber	
A5			41	11	2.6	Fiber	Carbon Fiber	
A5			42	32	1.2	Fiber	Carbon Fiber	
A5			43	2.8	.69	Fiber	Carbon Fiber	
A5			44	22	2.4	Fiber	Carbon Fiber	
A5			45	17	1.7	Fiber	Carbon Fiber	
A5			46	8.6	1	Fiber	Carbon Fiber	
A5			47	11	.83	Fiber	Carbon Fiber	
A6	E4A	6	48	19	1.4	Fiber	Carbon Fiber	
A6			49	6.9	1.4	Fiber	Carbon Fiber	
A6			50	37	2.4	Fiber	Carbon Fiber	
A6			51	12	.48	Fiber	Carbon Fiber	
A6			52	16	2.2	Fiber	Carbon Fiber	
A6			53	7.3	.97	Fiber	Carbon Fiber	
			54	17	1.2	Fiber	Carbon Fiber	
A6			55	21	1	Fiber	Carbon Fiber	
A6			56	12	1	Fiber	Carbon Fiber	
A6	E4C	7	57	16	2.6	Fiber	Carbon Fiber	
A6			58	13	2.1	Fiber	Carbon Fiber	
A6			59	32	1.9	Fiber	Carbon Fiber	
A6			60	4.1	1.2	Fiber	Carbon Fiber	
A6			61	41	6.2	Fiber	Carbon Fiber	
A6			62	15	1.7	Fiber	Carbon Fiber	
A6	F4A	8	63	21	1.4	Fiber	Carbon Fiber	
A6			64	2.6	.55	Fiber	Carbon Fiber	
A6			65	52	.83	Fiber	Carbon Fiber	
A6			66	6.6	1.4	Fiber	Carbon Fiber	
A6			67	52	.69	Fiber	Carbon Fiber	
A6			68	58	1.2	Fiber	Carbon Fiber	
A6			69	11	1	Fiber	Carbon Fiber	
A6			70	27	1.6	Fiber	Carbon Fiber	
A6			71	31	1.5	Fiber	Carbon Fiber	
A6			72	32	2.4	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU913

Method: TEM\EDS

Lab Sample No: AT05922-5

Analyst: KRP

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
A6			73	6.9	2.1	Fiber	Carbon Fiber	
A6	F4C	9	74	12	2.3	Fiber	Carbon Fiber	
A6			75	9.3	2.6	Fiber	Carbon Fiber	
A6			76	7.1	.9	Fiber	Carbon Fiber	
A6			77	7.6	1.7	Fiber	Carbon Fiber	
A6	G4A	10	78	24	2.1	Fiber	Carbon Fiber	
A6			79	22	1.4	Fiber	Carbon Fiber	
A6			80	9.5	1	Fiber	Carbon Fiber	
A6			81	21	2.6	Fiber	Carbon Fiber	
A6			82	37	3.8	Fiber	Carbon Fiber	
A6			83	6.6	.48	Fiber	Carbon Fiber	
A6			84	16	2.3	Fiber	Carbon Fiber	
A6	G4C	11	85	63	2.1	Fiber	Carbon Fiber	
A6			86	13	1.7	Fiber	Carbon Fiber	
A6			87	51	3.5	Fiber	Carbon Fiber	
A6			88	41	2.6	Fiber	Carbon Fiber	
A6			89	17	1.4	Fiber	Carbon Fiber	
A6			90	15	1.2	Fiber	Carbon Fiber	
			91	58	1.4	Fiber	Carbon Fiber	
A6			92	22	3.1	Fiber	Carbon Fiber	
A6			93	9	.55	Fiber	Carbon Fiber	
A6			94	9.3	1	Fiber	Carbon Fiber	
A6			95	6.6	.69	Fiber	Carbon Fiber	
A6	H4A	12	96	17	1.2	Fiber	Carbon Fiber	
A6			97	42	4.8	Fiber	Carbon Fiber	
A6			98	6.6	1.1	Fiber	Carbon Fiber	
A6			99	17	1.7	Fiber	Carbon Fiber	
A6			100	16	1.5	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU944

Method: TEM\EDS

Lab Sample No: AT05922-6

Analyst: KRP

id	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
A6	E3A	1	1	17	4	Fiber	Carbon Fiber	
A6			2	69	.6	Fiber	Carbon Fiber	
A6	E3C	2	NSD					
A6	F3A	3	3	26	4	Fiber	Carbon Fiber	
A6	F3C	4	4	100	2	Fiber	Carbon Fiber	
A6			5	38	2	Fiber	Carbon Fiber	
A6			6	41	10	Fiber	Carbon Fiber	
A6			7	25	2	Fiber	Carbon Fiber	
A6	G3A	5	NSD					
A6	G3C	6	NSD					
A6	G3D	7	8	19	.8	Fiber	Carbon Fiber	
A6			9	52	1	Fiber	Carbon Fiber	
A6			10	12	1	Fiber	Carbon Fiber	
A6	G3B	8	11	100	1	Fiber	Carbon Fiber	
A6			12	36	2	Fiber	Carbon Fiber	
A6	F3D	9	NSD					
	F3B	10	13	8	1	Fiber	Carbon Fiber	
A6			14	11	1	Fiber	Carbon Fiber	
A6	E3D	11	15	21	2	Fiber	Carbon Fiber	
A6	E3B	12	NSD					
A6	C3D	13	NSD					
A6	C3B	14	16	24	2	Fiber	Carbon Fiber	
A6	C4A	15	17	24	3	Fiber	Carbon Fiber	
A6			18	5	1	Fiber	Carbon Fiber	
A6	C4C	16	19	36	1	Fiber	Carbon Fiber	
A6			20	45	3	Fiber	Carbon Fiber	
A6	E4A	17	21	19	.7	Fiber	Carbon Fiber	
A6			22	27	2	Fiber	Carbon Fiber	
A6	E4C	18	NSD					
A6	F4A	19	23	8	1	Fiber	Carbon Fiber	
A6			24	5	1	Fiber	Carbon Fiber	
A6			25	16	2	Fiber	Carbon Fiber	
A6	F4C	20	26	14	2	Fiber	Carbon Fiber	
A6	G4A	21	27	44	2	Fiber	Carbon Fiber	
A6			28	12	2	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU944

Method: TEM\EDS

Lab Sample No: AT05922-6

Analyst: KRP

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
A6			29	12	2	Fiber	Carbon Fiber	
A6	G4C	22	30	32	2	Fiber	Carbon Fiber	
A6			31	26	5	Fiber	Carbon Fiber	
A6			32	8	.6	Fiber	Carbon Fiber	
A6	H4A	23	33	31	4	Fiber	Carbon Fiber	
A6	H4C	24	NSD					
A6	H4D	25	NSD					
A6	H4B	26	NSD					
A6	G4D	27	34	10	2	Fiber	Carbon Fiber	
A6	G4B	28	35	6	.3	Fiber	Carbon Fiber	
A6			36	18	1	Fiber	Carbon Fiber	
A6			37	18	.6	Fiber	Carbon Fiber	
A6	F4D	29	NSD					
A6	F4B	30	38	.7	.1	Fiber	Carbon Fiber	
A6			39	26	3	Fiber	Carbon Fiber	
A6			40	6	1	Fiber	Carbon Fiber	
A6	E4D	31	41	18	1	Fiber	Carbon Fiber	
A6	E4B	32	NSD					
	C4D	33	42	19	2	Fiber	Carbon Fiber	
A6	C4B	34	43	1	.3	Fiber	Carbon Fiber	
A6	C5A	35	44	6	1	Fiber	Carbon Fiber	
A6			45	4	1	Fiber	Carbon Fiber	
A6	C5C	36	46	32	2	Fiber	Carbon Fiber	
A6			47	12	2	Fiber	Carbon Fiber	
A6			48	11	2	Fiber	Carbon Fiber	
A6	E5A	37	49	57	2	Fiber	Carbon Fiber	
A6			50	17	1	Fiber	Carbon Fiber	
A6			51	12	.8	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU903

Method: TEM\EDS

Lab Sample No: AT05922-7

Analyst: KRP

id	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
B6	E5A	1	1	8.3	1.4	Fiber	Carbon Fiber	
B6			2	9.7	1	Fiber	Carbon Fiber	
B6			3	78	3.8	Fiber	Carbon Fiber	
B6			4	43	1.2	Fiber	Carbon Fiber	
B6			5	4.8	.69	Fiber	Carbon Fiber	
B6			6	52	3.8	Fiber	Carbon Fiber	
B6			7	17	1	Fiber	Carbon Fiber	
B6			8	31	1.4	Fiber	Carbon Fiber	
B6			9	1.7	.35	Fiber	Carbon Fiber	
B6			10	17	.69	Fiber	Carbon Fiber	
B6	E5C	2	11	27	.69	Fiber	Carbon Fiber	
B6			12	9	1.4	Fiber	Carbon Fiber	
B6			13	11	2.4	Fiber	Carbon Fiber	
B6			14	18	3.5	Fiber	Carbon Fiber	
B6			15	38	2.4	Fiber	Carbon Fiber	
B6			16	12	2.1	Fiber	Carbon Fiber	
			17	16	1.4	Fiber	Carbon Fiber	
B6			18	31	.83	Fiber	Carbon Fiber	
B6			19	41	1.2	Fiber	Carbon Fiber	
B6			20	13	2.4	Fiber	Carbon Fiber	
B6			21	19	4.7	Fiber	Carbon Fiber	
B6			22	19	.83	Fiber	Carbon Fiber	
B6			23	21	1	Fiber	Carbon Fiber	
B6			24	31	1	Fiber	Carbon Fiber	
B6			25	16	2.1	Fiber	Carbon Fiber	
B6			26	15	1.7	Fiber	Carbon Fiber	
B6	F5A	3	27	11	1.2	Fiber	Carbon Fiber	
B6			28	37	1	Fiber	Carbon Fiber	
B6			29	6.6	2.1	Fiber	Carbon Fiber	
B6			30	9.3	2.4	Fiber	Carbon Fiber	
B6			31	37	2.4	Fiber	Carbon Fiber	
B6			32	38	1.4	Fiber	Carbon Fiber	
B6			33	17	2.4	Fiber	Carbon Fiber	
B6			34	12	.69	Fiber	Carbon Fiber	
B6			35	39	.69	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU903

Method: TEM\EDS

Lab Sample No: AT05922-7

Analyst: KRP

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
B6			36	36	1.2	Fiber	Carbon Fiber	
B6			37	17	2.1	Fiber	Carbon Fiber	
B6			38	32	.69	Fiber	Carbon Fiber	
B6			39	12	1.4	Fiber	Carbon Fiber	
B6			40	11	.69	Fiber	Carbon Fiber	
B6			41	12	2.1	Fiber	Carbon Fiber	
B6			42	10	1.2	Fiber	Carbon Fiber	
B6	F4C	4	43	5.2	1	Fiber	Carbon Fiber	
B6			44	36	2.6	Fiber	Carbon Fiber	
B6			45	12	1.4	Fiber	Carbon Fiber	
B6			46	37	2.1	Fiber	Carbon Fiber	
B6			47	15	2.4	Fiber	Carbon Fiber	
B6			48	13	1.2	Fiber	Carbon Fiber	
B6			49	43	1.4	Fiber	Carbon Fiber	
B6			50	15	1.2	Fiber	Carbon Fiber	
B6			51	12	2.1	Fiber	Carbon Fiber	
B6			52	8	1.6	Fiber	Carbon Fiber	
B6			53	16	1	Fiber	Carbon Fiber	
			54	15	1.4	Fiber	Carbon Fiber	
B6			55	18	2.3	Fiber	Carbon Fiber	
B7	F4A	5	56	59	2.4	Fiber	Carbon Fiber	
B7			57	21	1.2	Fiber	Carbon Fiber	
B7			58	26	.69	Fiber	Carbon Fiber	
B7			59	32	1.4	Fiber	Carbon Fiber	
B7			60	4.1	.69	Fiber	Carbon Fiber	
B7			61	26	1	Fiber	Carbon Fiber	
B7			62	4.1	1	Fiber	Carbon Fiber	
B7			63	17	2.1	Fiber	Carbon Fiber	
B7			64	16	1	Fiber	Carbon Fiber	
B7			65	11	.69	Fiber	Carbon Fiber	
B7			66	9.7	.69	Fiber	Carbon Fiber	
B7			67	53	1	Fiber	Carbon Fiber	
B7			68	13	1.4	Fiber	Carbon Fiber	
B7			69	17	2.8	Fiber	Carbon Fiber	
B7	F4C	6	70	31	2.1	Fiber	Carbon Fiber	
B7			71	32	1	Fiber	Carbon Fiber	
B7			72	30	1	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU903

Method: TEM\EDS

Lab Sample No: AT05922-7

Analyst: KRP

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
B7			73	37	2.1	Fiber	Carbon Fiber	
B7			74	6.6	1.4	Fiber	Carbon Fiber	
B7			75	15	1.4	Fiber	Carbon Fiber	
B7			76	7.3	.69	Fiber	Carbon Fiber	
B7			77	20	1.4	Fiber	Carbon Fiber	
B7			78	30	3.1	Fiber	Carbon Fiber	
B7			79	7.6	1	Fiber	Carbon Fiber	
B7			80	57	1.4	Fiber	Carbon Fiber	
B7			81	16	1.7	Fiber	Carbon Fiber	
B7			82	17	2.4	Fiber	Carbon Fiber	
B7			83	8.6	1	Fiber	Carbon Fiber	
B7			84	6.2	.69	Fiber	Carbon Fiber	
B7			85	6.9	.55	Fiber	Carbon Fiber	
B7			86	21	3.3	Fiber	Carbon Fiber	
B7	G4A	7	87	5.5	.83	Fiber	Carbon Fiber	
B7			88	17	2.8	Fiber	Carbon Fiber	
B7			89	2.1	.55	Fiber	Carbon Fiber	
B7			90	32	5.2	Fiber	Carbon Fiber	
			91	17	.69	Fiber	Carbon Fiber	
B7			92	15	1.2	Fiber	Carbon Fiber	
B7			93	6.2	1.7	Fiber	Carbon Fiber	
B7			94	5.2	1	Fiber	Carbon Fiber	
B7			95	17	3.1	Fiber	Carbon Fiber	
B7			96	30	1	Fiber	Carbon Fiber	
B7			97	15	2.4	Fiber	Carbon Fiber	
B7			98	15	1.2	Fiber	Carbon Fiber	
B7			99	17	1.2	Fiber	Carbon Fiber	
B7			100	20	2.2	Fiber	Carbon Fiber	
B7			101	3.8	1	Fiber	Carbon Fiber	
B7			102	11	2.4	Fiber	Carbon Fiber	
B7			103	26	2.3	Fiber	Carbon Fiber	
B7			104	25	2.4	Fiber	Carbon Fiber	
B7			105	8	1.4	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00/
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU904

Method: TEM\EDS

Lab Sample No: AT05922-8

Analyst: KRP

id	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
C6	F4A	1	1	2.8	.28	Fiber	Carbon Fiber	
C6			2	5.2	1.5	Fiber	Carbon Fiber	
C6			3	8	1.9	Fiber	Carbon Fiber	
C6			4	9	2.1	Fiber	Carbon Fiber	
C6			5	3.1	.83	Fiber	Carbon Fiber	
C6			6	33	3.8	Fiber	Carbon Fiber	
C6			7	16	1	Fiber	Carbon Fiber	
C6			8	2.8	1	Fiber	Carbon Fiber	
C6			9	21	4.8	Fiber	Carbon Fiber	
C6	F4C	2	10	9	2.4	Fiber	Carbon Fiber	
C6			11	17	1	Fiber	Carbon Fiber	
C6			12	17	1.4	Fiber	Carbon Fiber	
C6			13	12	1.4	Fiber	Carbon Fiber	
C6	G4A	3	14	18	2.4	Fiber	Carbon Fiber	
C6			15	32	1.4	Fiber	Carbon Fiber	
C6			16	15	.69	Fiber	Carbon Fiber	
			17	6.6	1.4	Fiber	Carbon Fiber	
C6			18	6.6	1.2	Fiber	Carbon Fiber	
C6			19	21	3.5	Fiber	Carbon Fiber	
C6			20	16	.69	Fiber	Carbon Fiber	
C6			21	16	1	Fiber	Carbon Fiber	
C6			22	27	2.4	Fiber	Carbon Fiber	
C6			23	97	2.4	Fiber	Carbon Fiber	
C6			24	24	2.1	Fiber	Carbon Fiber	
C6			25	15	1	Fiber	Carbon Fiber	
C6			26	25	1	Fiber	Carbon Fiber	
C6			27	22	1.5	Fiber	Carbon Fiber	
C6			28	7.6	1.4	Fiber	Carbon Fiber	
C6	G4C	4	29	9	1	Fiber	Carbon Fiber	
C6			30	54	1.4	Fiber	Carbon Fiber	
C6			31	68	3.2	Fiber	Carbon Fiber	
C6			32	37	2.1	Fiber	Carbon Fiber	
C6			33	26	2.8	Fiber	Carbon Fiber	
C6			34	12	1.4	Fiber	Carbon Fiber	
C6			35	8.6	2.1	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU904

Method: TEM\EDS

Lab Sample No: AT05922-8

Analyst: KRP

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
C6			36	28	2.2	Fiber	Carbon Fiber	
C6			37	1.7	.48	Fiber	Carbon Fiber	
C6			38	1	.28	Fiber	Carbon Fiber	
C6			39	8	2.1	Fiber	Carbon Fiber	
C6	H4A	5	40	11	1.9	Fiber	Carbon Fiber	
C6			41	9	1.4	Fiber	Carbon Fiber	
C6			42	10	.69	Fiber	Carbon Fiber	
C6			43	83	2.4	Fiber	Carbon Fiber	
C6			44	11	1.2	Fiber	Carbon Fiber	
C6			45	2.8	.62	Fiber	Carbon Fiber	
C6			46	2.4	.35	Fiber	Carbon Fiber	
C6			47	20	2.3	Fiber	Carbon Fiber	
C6			48	13	1.7	Fiber	Carbon Fiber	
C6			49	3.2	.69	Fiber	Carbon Fiber	
C6			50	13	2.8	Fiber	Carbon Fiber	
C6			51	55	1	Fiber	Carbon Fiber	
C6			52	30	1.6	Fiber	Carbon Fiber	
C6			53	37	2.4	Fiber	Carbon Fiber	
	C3B	6	54	10	1	Fiber	Carbon Fiber	
C7			55	14	1.2	Fiber	Carbon Fiber	
C7			56	53	2.1	Fiber	Carbon Fiber	
C7			57	13	1.9	Fiber	Carbon Fiber	
C7			58	3.8	1	Fiber	Carbon Fiber	
C7			59	3.7	.55	Fiber	Carbon Fiber	
C7			60	6.9	1.4	Fiber	Carbon Fiber	
C7			61	18	3.5	Fiber	Carbon Fiber	
C7			62	11	1.5	Fiber	Carbon Fiber	
C7			63	11	.83	Fiber	Carbon Fiber	
C7			64	2.1	.35	Fiber	Carbon Fiber	
C7			65	2.4	.35	Fiber	Carbon Fiber	
C7			66	8.3	.55	Fiber	Carbon Fiber	
C7	C3D	7	67	57	1	Fiber	Carbon Fiber	
C7			68	9	2.3	Fiber	Carbon Fiber	
C7			69	22	6.6	Fiber	Carbon Fiber	
C7			70	1.2	.21	Fiber	Carbon Fiber	
C7			71	28	2.1	Fiber	Carbon Fiber	
C7			72	17	2.1	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU904

Method: TEM\EDS

Lab Sample No: AT05922-8

Analyst: KRP

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU904

Method: TEM\EDS

Lab Sample No: AT05922-8

Analyst: KRP

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
C7	E3B	8	73	11	1	Fiber	Carbon Fiber	
C7			74	63	1.9	Fiber	Carbon Fiber	
C7			75	17	5	Fiber	Carbon Fiber	
C7			76	20	3.5	Fiber	Carbon Fiber	
C7			77	9	.55	Fiber	Carbon Fiber	
C7			78	9	2.1	Fiber	Carbon Fiber	
C7			79	16	4.5	Fiber	Carbon Fiber	
C7			80	19	2.1	Fiber	Carbon Fiber	
C7			81	8.6	1.4	Fiber	Carbon Fiber	
C7	E3D	9	82	7.6	1.9	Fiber	Carbon Fiber	
C7			83	18	2.1	Fiber	Carbon Fiber	
C7			84	11	1.7	Fiber	Carbon Fiber	
C7			85	12	2.1	Fiber	Carbon Fiber	
C7			86	3.1	.28	Fiber	Carbon Fiber	
C7			87	11	1.2	Fiber	Carbon Fiber	
			88	34	1.2	Fiber	Carbon Fiber	
C7			89	42	1.2	Fiber	Carbon Fiber	
C7			90	7.6	2.4	Fiber	Carbon Fiber	
C7			91	4.8	.35	Fiber	Carbon Fiber	
C7			92	11	1.9	Fiber	Carbon Fiber	
C7	F3B	10	93	73	2.8	Fiber	Carbon Fiber	
C7			94	6.9	1.7	Fiber	Carbon Fiber	
C7			95	26	4.1	Fiber	Carbon Fiber	
C7			96	4.1	.62	Fiber	Carbon Fiber	
C7			97	21	3	Fiber	Carbon Fiber	
C7			98	19	.9	Fiber	Carbon Fiber	
C7			99	6.6	1.4	Fiber	Carbon Fiber	
C7			100	1	.14	Fiber	Carbon Fiber	
C7			101	9.3	2.1	Fiber	Carbon Fiber	
C7			102	24	4.5	Fiber	Carbon Fiber	
C7			103	26	2.4	Fiber	Carbon Fiber	
C7			104	6.2	1.4	Fiber	Carbon Fiber	
C7			105	22	2.4	Fiber	Carbon Fiber	
C7			106	16	1.2	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU904

Method: TEM\EDS

Lab Sample No: AT05922-8

Analyst: KRP

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
C7			107	11	.41	Fiber	Carbon Fiber	
C7			108	17	1.7	Fiber	Carbon Fiber	
C7			109	26	3.8	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU906 Method: TEM\EDS

Lab Sample No: AT05922-9 Analyst: KRP

id	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
D6	E3A	1	NSD					
D6	E3C	2	1	17	1.1	Fiber	Carbon Fiber	
D6			2	6.6	1.2	Fiber	Carbon Fiber	
D6			3	97	2.8	Fiber	Carbon Fiber	
D6	F3A	3	4	50	2.1	Fiber	Carbon Fiber	
D6			5	15	1.4	Fiber	Carbon Fiber	
D6	F3C	4	6	5.5	1.4	Fiber	Carbon Fiber	
D6			7	11	1.1	Fiber	Carbon Fiber	
D6			8	5.9	1	Fiber	Carbon Fiber	
D6	G3A	5	9	64	2.2	Fiber	Carbon Fiber	
D6			10	5.5	.9	Fiber	Carbon Fiber	
D6			11	9	1.9	Fiber	Carbon Fiber	
D6			12	9.7	.97	Fiber	Carbon Fiber	
D6	G3C	6	13	10	.62	Fiber	Carbon Fiber	
D6			14	41	.69	Fiber	Carbon Fiber	
D6			15	26	1.1	Fiber	Carbon Fiber	
	C4C	7	16	13	1.2	Fiber	Carbon Fiber	
D6	E4A	8	NSD					
D6	E4C	9	17	10	2.4	Fiber	Carbon Fiber	
D6			18	19	.69	Fiber	Carbon Fiber	
D6			19	19	.55	Fiber	Carbon Fiber	
D6			20	21	2.3	Fiber	Carbon Fiber	
D6	F4A	10	21	26	2.3	Fiber	Carbon Fiber	
D6			22	18	1	Fiber	Carbon Fiber	
D6			23	50	1.7	Fiber	Carbon Fiber	
D7	C3A	11	24	40	1	Fiber	Carbon Fiber	
D7	C3C	12	25	21	1.2	Fiber	Carbon Fiber	
D7			26	13	1.7	Fiber	Carbon Fiber	
D7			27	27	2.2	Fiber	Carbon Fiber	
D7			28	8.3	1.7	Fiber	Carbon Fiber	
D7			29	6.6	1.4	Fiber	Carbon Fiber	
D7			30	35	1.4	Fiber	Carbon Fiber	
D7	E3A	13	NSD					
D7	E3C	14	31	23	2.1	Fiber	Carbon Fiber	
D7	F3A	15	32	26	1.2	Fiber	Carbon Fiber	

NSD: No Structures Detected

Analytical Results
for
CLAYTON ENVIRONMENTAL CONSULTANTS

Client Reference Number: 75.99243.00
Clayton Order Number: AT05922

TRANSMISSION ELECTRON MICROSCOPY (TEM)
COUNT SHEET

Client Sample ID: CU906

Method: TEM\EDS

Lab Sample No: AT05922-9

Analyst: KRP

Grid	GO ID	GO Nbr	Structure Number	Length (μm)	Width (μm)	Structure Type	Fiber Type	MGraph
D7	F3C	16	NSD					
D7	C5A	17	NSD					
D7	C5C	18	33	19	1.7	Fiber	Carbon Fiber	
D7	E5A	19	NSD					
D7	E5C	20	34	11	1.6	Fiber	Carbon Fiber	
D7			35	7.6	.69	Fiber	Carbon Fiber	
D7			36	59	1.7	Fiber	Carbon Fiber	

NSD: No Structures Detected